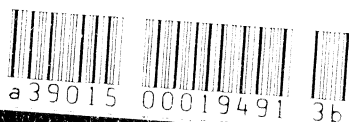


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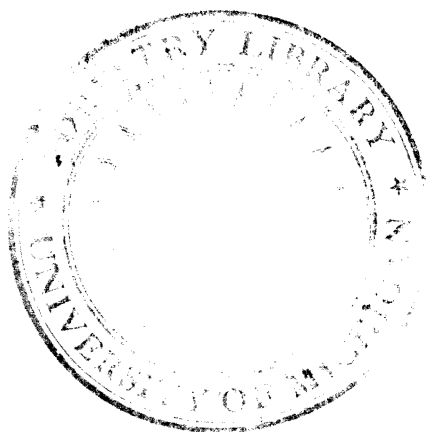
HAWAII
(Ter.)
BOARD
OF
AGRI-
CULTURE
AND
FORESTRY

REPORT

1908-10

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ISSUED MARCH 11, 1909

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1938

FIFTH REPORT
OF THE
BOARD OF COMMISSIONERS OF
AGRICULTURE AND FORESTRY
OF THE
TERRITORY OF HAWAII

FOR THE YEAR ENDING DECEMBER 31, 1908



HONOLULU:
THE HAWAIIAN GAZETTE CO., LTD.
1909

Board of Agriculture and Forestry

FOREST AND ORNAMENTAL TREE SEED AND SEEDLINGS FOR SALE AT THE GOVERNMENT NURSERY.

The Division of Forestry keeps constantly on hand at the Government Nursery, seed and seedlings of the important native and introduced trees. These are sold at prices just covering the cost of collection and growing.

The list includes both forest and ornamental trees, such as Silk Oak, Koa, various species of Eucalyptus, Golden and Pink Showers, Pride of India, Poinciana, Albizzia, etc. The price of the seed varies from 10 to 50 cents per ounce. The seedlings may be had for 2½ cents each, except a few kinds which are 5 cents. Seed of the various palms is also for sale; the price per 100 varying from \$1.00 to \$2.50. All seed is tested before being sent out, which insures its being good.

All communications in regard to seed or trees should be addressed to David Haughs, Forest Nurseryman, Box 331, Honolulu, Hawaii.

RALPH S. HOSMER,
Superintendent of Forestry.

DIVISION OF ENTOMOLOGY.

To give information about insects free of charge is one of the duties of this Division and Hawaiian readers are hereby invited to make inquiry in person and by mail. In order to be able to advise intelligently or send the right kind of useful insects for relief we like and sometimes it is indispensable for us to see the insect suspected or caught in the act of depredation, also specimens of the injury. In a tin with a hole or two, or a wooden box specimens may be mailed at 3rd class rates. Whether or not specimens are accompanied by letter **ALWAYS** write your name and address in the upper left-hand corner of the package. Address all communications, SUPERINTENDENT, DIVISION OF ENTOMOLOGY, P. O. BOX 331, HONOLULU, HAWAII.

JACOB KOTINSKY,
Superintendent of Entomology.



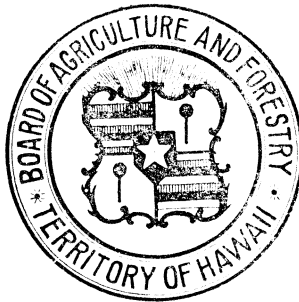
Alexander Caw

AUGUST 3, 1850

JUNE 28, 1908

ISSUED MARCH 11, 1909

FIFTH REPORT
OF THE
BOARD OF COMMISSIONERS OF
AGRICULTURE AND FORESTRY
OF THE
TERRITORY OF HAWAII
FOR THE YEAR ENDING DECEMBER 31, 1908



HONOLULU:
THE HAWAIIAN GAZETTE CO., LTD.,
1909

OFFICERS AND STAFF

OF THE

Board of Commissioners of Agriculture and Forestry

1909

COMMISSIONERS

NAME.	TERM EXPIRES.
MARSTON CAMPBELL, <i>President and Executive Officer,</i>	January 1, 1914
P. R. ISENBERG	" " 1910
H. M. VON HOLT	" " 1911
ALBERT WATERHOUSE	" " 1912
J. M. DOWSETT	" " 1913

DIVISION OF FORESTRY

RALPH S. HOSMER, *Superintendent of Forestry and Chief Fire Warden.*

DAVID HAUGHS, *Forest Nurseryman.*

JOSEPH F. ROCK, *Botanical Collector.*

DAVID KAPIHE, *Forest Ranger for Tantalus.*

DIVISION OF ENTOMOLOGY

JACOB KOTINSKY, *Superintendent of Entomology and Territorial Entomologist.*

A. KOEBELE, *Consulting Entomologist.*

....., *Assistant Entomologist.*

D. B. KUHNS, *Inspector's Assistant.*

B. M. NEWELL, *Fruit and Plant Inspector at Hilo, Hawaii.*

ROBT. R. ELGIN	} <i>Fruit and Plant Inspector.</i>	{ <i>at Mahukona, Hawaii.</i>
W. O. AIKEN		
W. D. MCBRYDE			(Honorary)	{ at Kahului, Maui.

DIVISION OF ANIMAL INDUSTRY

VICTOR A. NORGAARD, *Superintendent and Territorial Veterinarian.*

LEONARD N. CASE, *Assistant Territorial Veterinarian.*

H. B. ELLIOT, *Deputy Territorial Veterinarian, Hawaii.*

J. CHARLTON FITZGERALD, *Deputy Territorial Veterinarian, Maui.*

EDITOR, HAWAIIAN FORESTER AND AGRICULTURIST

L. G. BLACKMAN.

CONTENTS.

BOARD OF AGRICULTURE AND FORESTRY.

	PAGE.
Report of the Commissioners.....	1
Personnel	1
Meetings	1
Publications	1
Division of Forestry.....	2
Division of Entomology.....	4
Biographical sketch of Alexander Craw.....	4
Division of Animal Industry.....	7
Bee Industry	8
General	8
Appropriations	9

DIVISION OF FORESTRY.

Report of Superintendent of Forestry.....	11
Introduction	11
Staff and appropriations.....	13
Forest reserves	14
Reserves established	14
Forest reserve statistics	15
Tables showing areas of forest reserves.....	16-17
Reserves projected	18
Forest areas	18
Underlying principles of the Hawaiian forest policy.....	19
The application of the principles.....	20
Forest rangers	21
Forest reserve fencing.....	22
Forest fire fund	23
Hawaiian Sugar Planters' Association Resolution.....	23
Damage by goats	23
Forest Extension	24
Experimental garden	24
Plant introduction of special importance.....	25
Experimental tree planting on the high mountains.....	25
Progress in forest planting.....	26
Table showing trees planted	27-28
A look ahead	28
Recommendation	29
Tree planting under the Government leases.....	30
Miscellaneous forest work.....	31
Forest management	32
The Hawaiian Mahogany Lumber Company.....	32
Utilization of the commercial forest.....	33
Supervision of lumbering	33
Publicity in forest work	34
Territorial Conservation Commission.....	35
The Conference of the Governors.....	35
Appointment of Conservation Commission.....	35
Visit of Honorable F. H. Newell.....	36
Botanical collection	36
Fungus disease on Maui.....	38
Arbor Day	38
Nuuanu and Tantalus forests.....	39

	PAGE.
Rubber investigations	39
The present status of rubber in Hawaii.....	39
The terms of the experiment.....	39
Results of the tapping tests.....	41
Results of experiments in tapping Ceara rubber.....	41
Mr. Waterhouse's report on rubber.....	42
The district foresters	43
Reports of district foresters.....	43
Report of Mr. A. F. Knudsen.....	43
" " Mr. F. Gay.....	43
" " Mr. John Herd	44
" " Mr. H. B. Penhallow.....	45
" " Mr. L. von Tempsky.....	45
Maui Agricultural Company's tree planting.....	49
Report of Mr. George C. Watt.....	50
Mr. Bluett's report on the Kohala forest.....	51
Report of Mr. John Watt.....	52
" " Mr. R. von L. Domkowiez.....	52
" " Mr. John A. Maguire.....	52
Forest fire service	53
List of forest fires during 1908.....	54
Summary of recommendations.....	54
Report of the Forest Nurseryman.....	56
Nursery	56
Valuable introductions	56
Arbor Day	57
Plant distribution	57
Realizations	58
Congressional vegetable seed	58
Advice and assistance	59
Awini Tract, Kohala, Hawaii.....	59
Paumahu, Waialua, Oahu	59
Pauhala, Waikele, Oahu	59
Nuuanu Valley, Oahu.....	59
Honolulu Plantation, Oahu.....	59
Examining of tree planting on Kauai.....	60
Waianae Kai forest reserve	60
New experiment garden, Makiki.....	61
Nuuanu forest	62
Tantalus forest	62
List of district foresters	63
List of district fire wardens.....	67
Preliminary Report of the Territorial Commission of Hawaii.....	72
Introduction	72
Waters	73
Forests	73
Lands	74
Organization and work of the Commission.....	74
Recommendations	75
Appendix A. Report of the Committee on Forests.....	77
Table of forest reserves	81
Appendix B. Report of the Committee on Waters.....	82
Appendix C. Hawaiian sugar plantation statistics.....	84
Table of sugar production.....	87
Appendix D. Production of lime on the Island of Oahu.....	87
Hawaii. A statement by Governor Frear.....	88
The Declaration of the Governors.....	93

DIVISION OF ENTOMOLOGY.

	PAGE.
Report of Superintendent of Entomology.....	97
Staff	97
Superintendent	97
Consulting Entomologist	97
Assistant Entomologist	97
Inspectors and other Assistants.....	97
Acknowledgments	98
Lines of work	98
Inspection, quarantine and disinfection of imported vegetation,	
Table I.....	99
Records	99
Inspection table	99
Monthly, total average of quantity inspected and manner of	
disposal	100
Summary of table	101
Scabby potatoes	101
Greedy scale	101
Cabbage maggot in turnips.....	103
Soil	103
Fungus infested taro, sweet potatoes and yams from the	
Orient	103
Destruction	104
Fumigation	104
Dipping in Bordeaux and Formalin.....	105
Mail to other islands	105
Quarantine of imported pineapple plants.....	105
Regulation pertaining to honey and honey bee inspection..	106
Quarantine and inspection laboratory	106
Fumigatory exhaust	107
Pests intercepted in course of inspection.....	107
Bugs (Hemiptera-Homoptera)	107
Mealy bugs	107
Cottony scales	107
Terrapin scales	107
Armored scales	107
White flies	108
Plant lice	108
Moths (<i>Lepidoptera</i>).....	108
Ants (<i>Hymenoptera</i>).....	108
Beetles (<i>Coleoptera</i>).....	108
Miscellaneous	108
Local inspection	109
Introduction, breeding and distribution of useful insects.....	109
Introductions	109
Good work of a recently naturalized ally.....	110
Beneficial insect distribution	111
General work	111
Recommendations	112
Inter-island inspection	112
Melon fly (<i>Dacus cucurbitae</i>).....	112
Executive officer	113
Quantities and prices of fruits and vegetables imported via	
Honolulu during 1905-1908, Table II.....	114
Act 69, Session Laws of 1907, on bee inspection.....	115
Rules and regulations pertaining to the importation and inspec-	
tion of honey bees and honey, etc.....	116
Importation of queen bees, Rule 4.....	116
Labels	116

	PAGE.
Request for inspection	116
Inspection	117
Certificate	117
Destruction of cages, bees, etc.....	117
Importation of honey	117
Statement of importer	117
Inspection	118
Prof. Koebele's work on horn fly.....	119

DIVISION OF ANIMAL INDUSTRY.

Letter of submittal	123
Live stock inspection service.....	126
Rule 8—Quarantine of horse stock (horses, mules and asses) arriving from or through the State of California.....	133
Approval and assistance of Federal authorities.....	134
Quarantine stations	135
Results from inspection service	136
Importations of live stock.....	137
Mules	138
Horses	138
Cattle	138
Sheep	139
Hogs	139
Dogs	139
Poultry	139
Importation of live stock from New Zealand.....	140
Disease among live stock in the Territory.....	141
Glanders	141
Epizootic Laryngitis	142
Cerebro Spinal Meningitis	142
Tuberculosis	143
International Congress on Tuberculosis.....	144
Inter-State Association of Livestock Sanitary Boards.....	147
The pathological laboratory	150
Veterinary inspection and sanitary service for the Islands of Hawaii, Maui and Kanai	152
Appointment	152
Compensation	152
Official district	153
Duties	153
Report of the Deputy Territorial Veterinarian for the Hilo District. By H. B. Elliot, M. R. C. V. S.....	156
General observations	156
Port inspection	156
Local inspection	157
Quarantine station at Hilo.....	157
Contagious and infectious diseases.....	158
Glanders	158
Endemic Catarrhal Fever	158
Nature and occurrence	158
Symptoms	159
Prophylaxis	161
Osteoparosis	162
Strongylosis	162
Report of the Deputy Territorial Veterinarian for the District of Maui. By J. C. Fitzgerald, M. R. C. V. S.....	163
Glanders	164
Cerebro Spinal Meningitis	165
Strangles, Distemper and Catarrhal Fever.....	165

APPENDIX.

REPORT ON THE CULTIVATION OF RUBBER IN CEYLON AND
THE MALAY STATES.

	APPENDIX
	PAGE.
Introduction	1
Cost of production	2
Problems	3
Variety planted	3
Hevea or "Para" rubber.....	3
Physical conditions	3
Rainfall	4
Wind	4
Soil	4
Ceylon soils in which rubber is planted.....	6
Cabooky	6
Analysis of typical Cabooky soil.....	6
Alluvial soil	8
Analysis of Alluvial soil, Experiment Station, Peradeniya..	8
Tea and Cacao soils.....	9
Analysis of soil from typical cacao land.....	9
Analysis of soil from typical tea land.....	9
Swamps	10
Analysis of swamp rubber soils from the Southern Province.	10
Clearing	11
Lalang grass	11
Planting	15
Methods of planting	15
Nurseries	15
Transplanting	15
Planting in avenues.....	16
Weeding	16
Draining	16
Cultivating	16
How to close plant.....	22
Effect of close planting.....	23
Widest planting	23
Growth	23
Tapping	31
Days work	32
Scrap rubber	32
Labor	40
Ceara rubber	40

ILLUSTRATIONS.

PLATES.

	PAGE.
Plate I.—Alexander Crow	Frontispiece
Plate II.—Inspection, quarantine and fumigation laboratories on Oceanic dock	Facing page 106

PLATES IN APPENDIX.

	APPENDIX PAGE.
Plate 1.—Fifteen months' old Hevea.....	5
“ 2.—Two year old Hevea.....	12
“ 3.—Three months' old nursery and laborers' quarters.....	13
“ 4.—Same nursery at five months. Plants were one foot high when one month old.....	14
“ 5.—One year old trees and drain.....	17
“ 6.—Hevea planted 12x24—148 per acre. Age 2 yrs. and 7 mos.	18
“ 7.—Eleven year old Hevea planted 24x24—74 per acre.....	19
“ 8.—Seven and one-half year old Hevea.....	20
“ 9.—Eleven year old Hevea planted 10x10—435 per acre.....	21
“ 10.—Tapping twelve feet high. Eleven year old trees.....	24
“ 11.—Eight and a half year old Hevea planted 12x24—148 per acre	25
“ 12.—Eleven year old Hevea planted 60 per acre. Average yield 7 pounds per tree.....	26
“ 13.—Herringbone system of tapping.....*	21
“ 14.—Single “V” tapping. Seven and one-half year old trees.	28
“ 15.—Tapping tree in grove planted 12x24—148 per acre.....	29
“ 16.—Marking Hevea tree before tapping.....	30
“ 17.—Drying and packing room.....	33
“ 18.—Tamil coolies	34
“ 19.—Tamil girl	35
“ 20.—Javanese women and mandor (luna).....	36
“ 21.—Fourteen months' old Hevea and Tamil coolie.....	37
“ 22.—Fourteen months' old tree.....	38
“ 23.—Eight months' old tree.....	39
“ 24.—Ceara trees at Buitenzorg, Java, 8 years old.....	42
“ 25.—Cocoa plantation with cocoanut and Ceara rubber trees planted between the Cocoa.....	43
“ 26.—Tapping Ceara. Age of tree 4 or 5 years. Circumference 3 feet from the ground 38 inches.....	44
“ 27.—Same tree as photo No. 26.....	45
“ 28.—Making Ceara rubber “biscuits”.....	46
“ 29.—Twenty year old Ceara tree, showing method of tapping..	47
“ 30.—Tapping Ceara tree on renewed bark. Rangbodde estate.	50
“ 31.—Twenty-three year old Ceara rubber growing between tea plants	51
“ 32.—Tea estate, Rangbodde, Ceylon. Elevation 3,000 feet....	52

BOARD OF AGRICULTURE AND FORESTRY.

Report of the Commissioners.

To the Governor of Hawaii:

The report of the Board of Commissioners of Agriculture and Forestry for the year ending December 31, 1908, is herewith presented.

PERSONNEL.

There has been one change in the membership of the Board during the year through the resignation of Hon. George R. Carter and the appointment as his successor of Mr. H. M. von Holt. Mr. von Holt's appointment took effect on September 15, 1908. Because of anticipated absence from the Territory the resignations of Messrs. Holloway and Giffard as members of the Board have been handed to the Governor, to take effect on December 31, 1908.*

MEETINGS.

During the year the Board has held 14 regular and 3 executive meetings. Unless otherwise ordered two meetings are held every month, on the first and third Wednesdays, at 3 p. m. One forest reserve hearing has also been held jointly by the Governor and the Board.

PUBLICATIONS.

The publication of 'The Hawaiian Forester and Agriculturist' as the official organ of the Board has been continued during 1908. The magazine is edited by Mr. Leopold G. Blackman and is published by the Hawaiian Gazette Company. It contains the official reports submitted by various members of the Board's staff and special contributions dealing with Forestry, Entomology, Animal Industry, Horticulture, and General Agriculture. The articles are written with direct refer-

* As a matter of fact these two gentlemen continued to serve until January 15, 1909. On January 26 Governor Frear appointed Mr. Marston Campbell as President and Executive Officer, and Mr. J. M. Dowsett as Member of the Board.

ence to Hawaii and contain much that is of value to those interested in these subjects. The volume for 1908 (Vol. 5) contains 364 pages. Many of the articles are illustrated. The subscription price is one dollar a year.

There have also been issued during the year the following publications:

A circular (unnumbered) of the Division of Animal Industry entitled "Rules and Regulations pertaining to the Inspection and Testing of Live Stock intended for Importation from the Mainland of the United States to the Territory of Hawaii."

This circular contains the various regulations that became effective January 1, 1908, and other matter relative to the importation of live stock into Hawaii. This circular was issued January 25, 1908. One thousand copies were printed for local and mainland distribution.

On July 31, 1908, the Governor approved Rule 8 of the Division of Animal Industry, relating to the quarantine of horse stock arriving from or through the State of California. This was printed as an unnumbered leaflet and generally distributed.

General Circular Number 3 of the Board, entitled "Law and Regulations pertaining to the Importation and Inspection of Honey Bees and Honey Into the Territory of Hawaii," was issued on October 8, 1908. Five hundred copies were printed.

DIVISION OF FORESTRY.

The only change in the regular staff of the Division of Forestry in 1908 was the appointment in October of Mr. Joseph F. Rock as botanical collector. The work of the Division of Forestry during 1908 has followed the program adopted at the organization of the Division, five years ago. The creation of forest reserves continues to hold chief place. In 1908 three forest reserves on Maui and Hawaii, aggregating a total area of 46,429 acrs, were set apart by proclamation of the Governor. Other forest reserve projects were advanced by the completion of field work and by survey of the boundaries. The total area of the 16 forest reserves now established is 444,116 acres. Of this area sixty-one per cent. is Government land. It is estimated that the Kōa and Ohia type of forest, in which are all the forest reserves so far set apart, contains approximately 1,175,000 acres. Eventually it is probable that there will be included within the forest reserve boundaries about three-quarters of a million acres, of which about seventy per cent. will be Government land. The energies of the Division of Forestry will therefore continue to be directed toward the creation of forest reserves.

With the better understanding of the importance of forestry, and especially of the relation that the forest bears to stream-flow and irrigation, it has become apparent that better care should be given the forest than has been the case in the past. In his report the Superintendent of Forestry has recommended that provision be made for the employment of 12 forest rangers for the proper administration of the forest reserves, and also that there be made available money for fencing forest reserve boundaries on Government land and for fighting forest fire on Government land. The Board endorses these recommendations and has included them in the estimates of appropriations needed for the next fiscal period.

The second main branch of forest work in Hawaii is Forest Extension. The part played by the Division of Forestry in this work is to give advice and assistance to persons desiring to plant trees, to furnish at cost price forest tree seeds and seedlings from the Government Nursery, and to conduct experiments looking to the introduction into Hawaii of valuable exotic trees and shrubs. The better to carry on the last named work there has been established during the past year an experimental garden in Makiki Valley, in which new and rare plants started at the propagating houses at the Government Nursery can be planted out, kept under observation and eventually distributed. Tree planting by private corporations has increased considerably during 1908, practically half a million trees having been planted by sugar plantation companies and stock ranches. More tree planting would doubtless be done if the Division of Forestry could give more attention to the work. To meet this need the Superintendent of Forestry has recommended that an additional technically trained assistant be employed. This recommendation is approved by the Board, for the increasing calls on the Division of Forestry are not confined to Forest Extension alone. The growing importance of the lumber industry on the Island of Hawaii makes it highly desirable that the Government should undertake a thorough examination of its forests of the commercial class. The appointment of another assistant would enable the Division of Forestry to undertake this work.

The widespread interest in the conservation of natural resources has found expression in Hawaii in the appointment by the Governor of a Territorial Conservation Commission, of which the Superintendent of Forestry has been designated as chairman. The findings of this Commission bear so intimate a relation to the work of this Board that its report is reprinted as an appendix to the report of the Division of Forestry.

Notwithstanding the severe drought in many parts of the Territory the year 1908 has been remarkably free from damage by forest fire. This is probably due, in part at least, to the better public sentiment in regard to forest fires that has resulted from the Forest Fire Law enacted in 1905.

DIVISION OF ENTOMOLOGY.

The late Superintendent of this Division, Mr. Alexander Craw, became seriously ill the previous October. In the hope that recuperation on the Mainland would restore his health he sailed hence on February 19 under leave of absence. But he failed to rally and died on June 28. The following resolution, presented by the President, was adopted by rising vote of the Board and an illuminated copy sent to the widow:

"Whereas, The Commissioners of Agriculture and Forestry of the Territory of Hawaii have sustained a great loss in the death of Alexander Craw, Superintendent of the Division of Entomology;

"And, Whereas, The efficient manner in which he administered the duties of his office, has won the respect of all and resulted in lasting benefit to the agricultural interests of Hawaii;

"And, Whereas, By his genial and kindly manner he had endeared himself to his associates and all others with whom he came in contact;

"Therefore, Be it Resolved, That the Commissioners of Agriculture and Forestry extend to his widow their sincerest sympathy in her great bereavement, and that a copy of these Resolutions be spread on the minutes and be engrossed with the signatures of the Commissioners and presented to her."

His photograph (Frontispiece) and Biographical Sketch, by Jacob Kotinsky, are herein reproduced by courtesy of the Hawaiian Entomological Society from its Proceedings Vol. II, No. 1, pp. 24 and 25, October 1908:

BIOGRAPHICAL SKETCH OF ALEXANDER CRAW.

By Jacob Kotinsky.

"With the death of this remarkable man passes away another prominent figure from the horizon of American horticulture and economic entomology. Few economic entomologists are better known and no one more favorably than was he during his life work. Few entomological workers passed through

California without seeking out and making his personal acquaintance, and all were charmed with the man. His unvarying amiability has won for him a lasting abode in the heart of every one that knew him. By early training a capable and successful horticulturist, his indomitable love for plant life later led him to form the vanguard of a fight against horticultural enemies on a scale that was never undertaken before.

"Alexander Craw was born in Ayr, Scotland, August 3, 1850. In 1873 he emigrated to California and after a two years' residence in San Diego, moved to Los Angeles, where he took charge of the famous Wolfskill orange grove. His early training stood him in good stead in the early days of California's growth as a horticultural center. His authority in matters horticultural was never questioned and his advice ever eagerly sought. Presently *Icerya purchasi*, which had preceded his arrival in California by about five years, threatened the destruction of the citrus industry. It is difficult to determine at present who started the movement which culminated in the introduction of *Noctuid cardinalis* from Australia into California by Albert Koebele in 1888. But it is certain that Mr. Craw was a powerful factor in that movement. Never in our conversation in the office did he credit himself with the conspicuous role, yet it is quite evident to me that his constant agitation of the matter before the California horticultural organizations, and the incessant pressure he brought to bear by means of these upon authorities in Washington, was to a considerable degree responsible for Koebele's victorious mission. Once victory was achieved and that so completely and in such an unusual manner he was possessed with the idea of controlling all horticultural insect pests by means of their natural enemies.

"About 1890 he was prevailed upon to accept the office of inspector and entomologist under the California State Board of Horticulture, a line of work not previously undertaken anywhere and in which he spent the remainder of his life. Always kindly yet always firm in the performance of his duty he stood for fourteen years like a rock at the Golden Gate and jealously guarded his adopted state from horticultural pests of the world. All opposition he swept aside with a smile, without making a foe or losing a friend. He was a keen observer, so that by 1891 we find him not only familiar with the common garden and orchard pests, but describing a species of his favorite group, Hymenoptera Parasitica (*Coccophagus* (*Aspidiotiphagus*) *citrinus*, Bull. 57, California State Board of Horticulture, 1891). His writings are not profuse, and are confined almost entirely to periodical reports in which he aimed principally to enlighten his horticultural readers on

their insect problems as he viewed them. In Bull. 4, Tech. Ser., Division of Entomology, U. S. D. A., he published a list of the Coccidae which he found in course of inspection at San Francisco. A number of species and varieties named *Craavi* may be observed in catalogs of this family.

"In 1904 he was induced to enter the service of the Hawaiian Board of Agriculture as Superintendent of Entomology and Inspector. This office he filled in the same efficient manner that he had carried on the work in California, proving of great benefit to Hawaii in the exclusion of dangerous insect pests, and resulting in a better quality of fruits and vegetables being shipped here. His devotion to duty had the better of discretion, so that when on October 11, 1907, he was overtaken by the serious illness which on June 28, 1908, terminated his life, it was largely the result of overwork."

Mr. Jacob Kotinsky, the Assistant Entomologist, was in August temporarily and in September permanently appointed Superintendent of the Division. No Assistant Entomologist to succeed Mr. Kotinsky has yet been appointed. The Inspector's Assistant, Mr. G. A. Jordan, resigned August 15, and Mr. D. B. Kuhns was appointed in his place. The balance of the staff remains as before.

Inspection of imported fruits, plants and vegetables is as heretofore the principal work of this Division. Three hundred and forty-five vessels were boarded for inspection, and in the baggage, freight and mails traced and examined 143,822 packages. Because of a variety of insects and diseases 3,437 packages were ordered returned, 566 fumigated or otherwise treated before releasing, 47 refused landing and 198 destroyed.

Early in the year Mr. A. Koebele sent a variety of scale bug enemies from Mexico, which were bred and at least two of them promise results. Later, by arrangement with the Hawaiian Sugar Planters' Association, and the Hawaiian Live Stock Breeders' Association, Mr. Koebele was detailed to Europe in search of natural enemies of the horn fly. He has sent a number of lots which are being looked after by the Hawaiian Sugar Planters' Association entomologists.

As heretofore the Division has supplied information by letter and word of mouth upon injurious insects and diseases, and no request for a professional visit was denied. As a citizen, while consulting the Entomologist, said: "This is an institution for the people and I mean to make use of all such institutions." The Board reiterates its invitation to interested persons to freely consult the officers of this Division whenever necessary.

DIVISION OF ANIMAL INDUSTRY.

The force of the Division has during the year been increased by the appointment of two Deputy Territorial Veterinarians, one for the district of Hilo and one for the district of Maui. Their appointments were only effected through the coöperation of the local Sugar Planters' Association and various agricultural and live stock interests, which by taxing themselves at a pro rata scale provided a salary of \$100.00 per month for each of the two deputies. The value of this service has been fully demonstrated during the period in which it has been in effect, and it is hoped that the coming Legislature will see its way clear to provide funds for the salary of the two deputies above mentioned as well as for two more, one to look after Kohala and Hamakua and one to be stationed on Kauai. Such an arrangement would open all of the ports of entry of the Territory to the importation of live stock and would place the other islands on the same basis as Oahu as far as the eradication of infectious and contagious diseases among live stock is concerned.

The new regulations governing the importation of live stock, and which were published in the report for last year, went into effect on the 1st of January, 1908. These regulations, which made the inspection and testing of live stock compulsory before shipment to this Territory, and which placed this inspection and testing in the hands of the inspectors of the Federal Bureau of Animal Industry, have proven highly satisfactory. That glanders nevertheless, in one instance, gained entrance to the Territory with inspected and tested stock was not due to any defect in the regulations or their enforcement, but to the unfortunate live stock sanitary condition of California. The incident in question, which is fully discussed in this report, necessitated the promulgation of a new regulation imposing a quarantine of three weeks from the date of shipment on all horse stock arriving in the Territory from or through California. This regulation will continue in effect until conditions in California warrant its abrogation.

In regard to diseases among live stock, a considerable number of outbreaks of glanders have occurred on both Oahu, Maui and Hawaii.

On Hawaii a widespread epidemic of a catarrhal disease has prevailed among the horses on many plantations and ranches and has caused considerable loss. This disease is fully described in the appended report of the Deputy Territorial Veterinarian for the Hilo District.

Otherwise the general health of the live stock has been good, except so far as affected by the prolonged drouth, which has caused greater losses than ever known before.

BEE INDUSTRY.

Under Act 69 of the Session Laws of 1907 the Board of Agriculture and Forestry was charged with the duty of supervising the introduction of honey bees into Hawaii, and with the regulation of the Bee Industry. In compliance with this law regulations regarding the importation of queen bees and of honey were promulgated by the Board and approved by the Governor on September 17, 1908. These regulations were published as General Circular No. 3, already referred to. Further to carry out the provision of the law, on December 4, 1908, Mr. D. L. Van Dine, Entomologist of the Hawaii Experiment Station, was appointed honorary Apicultural Inspector of the Board.

GENERAL.

Substantial progress has been made during the past year in the several branches of work being carried on under the Board. The forest work helps to insure the continued supply of water, without which agriculture on a large scale, no matter what the crop, cannot be carried on successfully in Hawaii. The inspection work of the Division of Entomology prevents the introduction of injurious insects into the Territory. That of the Division of Animal Industry does a similar service by protecting the Territory against dangerous diseases of live stock. Through each of its divisions the Board of Agriculture and Forestry is of direct service to the people of Hawaii. Its work is not spectacular in operation, but in its results it touches practically every interest in the Islands. Were this relation better understood there is no question but that the Board would receive the additional financial support necessary to carry on its work in the most efficient manner. The object of this report is to present in readable form a statement of what the Board of Agriculture and Forestry is and what its work means to Hawaii.

Respectfully submitted,

C. S. HOLLOWAY,
W. M. GIFFARD,
H. M. VON HOLT,
P. R. ISENBERG,
ALBERT WATERHOUSE,
Commissioners.

Honolulu, Hawaii, December 31, 1908.

**APPROPRIATIONS FOR THE BOARD OF AGRICULTURE AND FORESTRY PASSED BY THE LEGISLATURE
AT THE SESSION OF 1907, FOR THE BIENNIAL FISCAL PERIOD, JULY 1, 1907, TO JUNE 30, 1909.**

Statement for the Calendar Year, 1908.

SALARIES AND PAY ROLLS.

	Appropri- ation	Balance Dec. 31, 1907	Drawn in 1908	Balance Dec. 31, 1908.
Salary of Superintendent of Forestry.....	\$ 6,000.00	\$ 4,500.00	\$ 3,000.00	\$ 1,500.00
Pay of Assistants, Laborers and Rangers, Division of Forestry.	9,240.00	7,234.50	4,895.42	2,339.08
Salary of Superintendent of Entomology.....	6,000.00	4,500.00	2,853.33	1,646.67
Pay of Assistants, Inspectors and Employees, Division of Entomology	11,280.00	8,489.00	4,800.00	3,680.00
Salary of Clerk and Stenographer.....	2,400.00	1,800.00	1,200.00	600.00
Pay of Employees and Laborers, Board of Agriculture and Forestry.	2,160.00	1,620.00	1,080.00	540.00
Salary of Superintendent of Animal Industry.....	6,000.00	4,500.00	3,000.00	1,500.00
Pay of Assistants and Laborers, Division of Animal Industry.	6,760.00	5,570.04	2,914.92	2,655.12
Totals.	\$19,840.00	\$38,204.54	\$23,743.67	\$14,460.87

CURRENT EXPENSES.

Incidentals and General Expenses, Board of Agriculture and Forestry.	\$37,050.00	\$32,182.02	\$16,640.73	\$15,541.29
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DIVISION OF FORESTRY.

Report of the Superintendent of Forestry.

Honolulu, Hawaii, December 31, 1908.

The Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

Gentlemen :

I have the honor to present my fifth annual report of the work of the Division of Forestry.

Throughout the United States the year nineteen hundred and eight has been rendered memorable by the large share of attention that has been given to the consideration of the conservation of natural resources. Regarded from whatever standpoint the Conference of Governors, held at Washintgon in May, was a notable gathering. It marks the real starting point of the movement for a wiser use of the sources of wealth on which rests the material prosperity of the Nation. Following and as a direct result of that meeting the investigations of the National and of the several State Conservation Commissions have resulted in the accumulation of a body of accurate information never before available. Everywhere in the country there has been awakened an active public sentiment in favor of Conservation that will find expression in ways that cannot but prove an uplift in the life of the Nation.

To Hawaii this general movement has peculiar significance. There are few localities where, as in these islands, continued economic prosperity depends so intimately on the wise use of waters, forests and lands. The thoughtful attention that is being given the subject on the mainland should emphasize and bring home to the people of this Territory the necessity for well conceived and far reaching plans for the management of the Hawaiian forests and for the development and more complete utilization of local waters.

Hawaii is and always must be a country essentially dependent on agriculture. Because of the climatic and topographic conditions that are characteristic of these islands agriculture on a large scale cannot successfully be carried on without irrigation. Irri-

gation presupposes an ample and sustained water supply. This in turn points directly to the conservation of the streams through the protection of the forest-cover on the important water sheds. To meet just this need is one of the main reasons why forestry is practiced in Hawaii.

The chief object of the Hawaiian forest reserves is to assist in making water available for human use. The creation of forest reserves—so far the most important forest work undertaken in Hawaii—is therefore the direct outcome of an economic necessity. The forest reserves are not made because they contain rare or beautiful trees, or because they happen to include some wonderful scenery, but purely and simply because it is sound business policy to protect the sources of the water that is needed for irrigation, power development, the fluming of cane and domestic supply. In other words the areas that are set apart as forest reserves are of greater value because they help to conserve water than they would be if used for any other purpose. There is no mystery about the matter. It is merely good common sense so to use the rough and inaccessible areas that constitute the water sheds of the streams in most of the windward districts that they shall safeguard the supply of water needed for the development of better lying lands. Recognition of this fact emphasizes the more forcibly the necessity for forest protection and the advisability of forest work, for water is needed not only for the land now under cultivation but also for the reclamation of other areas on each island of the group that with irrigation can be made productive.

In Hawaii the two principal needs in forestry are the protection, care and wise use of the existing native forest and the planting of otherwise unproductive areas with desirable trees. Approaching the subject from this second side it will be seen that forest planting is just as directly the result of an economic need as is the creation of forest reserves. In the face of the assured fact that the wood supply on the mainland is steadily diminishing, with a consequent rise in the price of all wood products, it is only following the dictates of common prudence to make provision as far as may be for a local source of supply.

For five years now the Territorial Government has systematically followed a definite policy in regard to forestry. The work carried on falls under two broad divisions; (1) the care of the existing forest, through the creation and administration of forest reserves, and (2) forest extension, which includes the introduction into the Territory of new trees of economic importance and the planting of areas that cannot otherwise be turned to account. The object of this report is to outline briefly what has been accomplished during the past year and to show why provision

should be made for the continuation of the work that has so far been done.

The features of special forest interest during 1908 are the extension of the forest reserve system, the strengthening of the sentiment in favor of forestry through the growth of a better understanding by the people of Hawaii of the aims and purposes of the forest policy of the Territorial Government, the appointment and recommendations of the Territorial Conservation Commission, the demonstration through systematic tapping experiments that rubber can be produced by the local rubber plantations at a profit, the continuation of the plant introduction work, organized on a large scale in 1907, and a very decided increase in tree planting by individuals and corporations.

The part played by the Division of Forestry in the last named work has been to furnish in large numbers trees for forest planting and to answer numerous calls for advice as to when, where and how to plant. The systematic introduction of valuable trees and shrubs into the Territory has been actively continued by the establishment in Makiki Valley of an experimental garden where promising exotic trees may be kept under observation so that later the kinds found to be desirable can be propagated for general distribution.

With the development of forest work in Hawaii needs have become apparent that must be met if the best results are to be obtained in future work. Appropriations for forestry in this Territory are in the nature of an investment. For where the development of a country is so directly dependent on the wise use of the natural resources as it is in these islands, money spent in making the forests or the waters better to serve the purposes to which man desires to put them, yields a direct return in increased crops and consequently in general prosperity.

STAFF AND APPROPRIATIONS.

The staff of the Division of Forestry consists of the Superintendent of Forestry (Ralph S. Hosmer) and the Forest Nurseryman (David Haughs). During the autumn of 1908 Joseph F. Rock has been employed as Botanical Collector, on work that will be continued during the present fiscal period. David Kapihe has remained as Forest Ranger for the Tantalus Heights District. Owing to lack of appropriation no other forest rangers have been commissioned. During the year a few changes have occurred in the personnel of the District Foresters and the District Fire Wardens. Revised lists of these volunteer officials are given elsewhere in this report.

The amounts appropriated for salaries and allotted to the Division of Forestry for current expenses under the general appropriation for the Board of Agriculture and Forestry for the present biennial fiscal period (July 1, 1907, to June 30, 1909), are as follows:

	Per Annum.	Per Period.
Salaries and pay rolls.....	\$ 7,620.00	\$15,240.00
Incidentals and general expenses....	4,960.00	9,920.00
	<hr/> \$12,580.00	<hr/> \$25,160.00

Adequately to carry on the work that it is within the province of the Division of Forestry to undertake requires an increase in appropriations. The particular purposes for which money is needed and the reasons why it is good policy for the Territory to increase its expenditures in this direction at this time are fully set forth in the following pages of this report.

FOREST RESERVES.

RESERVES ESTABLISHED.

The additions to the list of established forest reserves made during 1908 are the West Maui Forest Reserve, 144,440 acres—of which 19,105 acres is government land; the Makawao Forest Reserve, also on Maui, 1,796 acres, and the Waiaha Spring Forest Reserve, North Kona, Hawaii, 193 acres. The two last named reserves are entirely government land. Together these three reserves have a total area of 46,429 acres, of which 21,094 acres, or 45 per cent. is government land.

Each of the three reserves created during 1908 illustrates a principle in the forest reserve policy of the Territory. The West Maui Forest Reserve, which embraces the entire top of the West Maui Mountain above the line of agricultural land, is made essentially with the idea of protecting a water-bearing section on which depend large areas of agricultural land already under a high state of cultivation. The streams that rise in the West Maui Mountains are used for irrigation, for power development and for domestic supply. This reserve is one of the most important in the Hawaiian forest reserve system, because the streams that come from it water some of the most productive land in the Territory. The West Maui Forest Reserve includes both government and privately owned lands, but without exception the private owners are heartily in favor of the creation of the reserve. By fencing and through other action they have made the reserve effective, so that although the private areas

have not technically been turned over to the Division of Forestry for management, the whole area is nevertheless fully protected.

The Makawao Forest Reserve rounds out the area of native forest on the windward slope of Mt. Haleakala from which comes the water used in irrigating the great plain of Central Maui. It represents the logical fulfillment of plans for forest protection in a given district.

The purpose of the Waiaha Spring Forest Reserve is by the setting apart of a sufficient, though comparatively small area, to protect one of the few permanent springs in the District of Kona. Being on the leeward side of the Island of Hawaii and having a soil of extreme porosity, Kona is limited for its water supply to a very few springs and water holes. Waiaha Spring is one of the water holes that can be relied on even in times of continued drought. In a section where much of the forest belongs to the "Commercial Class" it is doubly important that whatever sources of permanent water supply do exist, shall be amply protected. All three reserves created during 1908 are of the "protection forest" type, which means that the forest in them should be strictly maintained and kept permanently intact.

FOREST RESERVE STATISTICS.

There have now been set apart sixteen forest reserves in the Territory of Hawaii. The combined total area is 444,116 acres, of which 61 per cent.—273,912 acres—is owned by the Territorial Government. The following tables show various data in connection with the established reserves, arranged both chronologically and by islands and counties. Reference may here be made to the Annual Report of the Division of Forestry for the year 1906, which contains maps showing the location of the reserves on the four large islands of the group and tables giving in detail the areas of the various lands making up the several reserves at that time established.

FOREST RESERVES, TERRITORY OF HAWAII.

Arranged in Chronological Order.

(Corrected to December 31, 1908.)

No.	Name.	District.	Island.	Total Area Recom- mended to be Reserved, Acres.	Area Gov- ernment Land, Acres.	Area Private Land, Acres.	Date of Proclamation.	Proclamation Signed by
1	Kaipapau.....	Koolauloa	Oahu	913	913	.....	Nov. 10, 1904	G. R. Carter
2	Hamakua Pali.....	Hamakua	Hawaii	18,940	16,333	2,607	Dec. 23, 1904	
Total for the year ending December 31, 1904.....				19,853	17,246	2,607		
3	Hilo.....	Hilo	Hawaii	110,000	60,223	49,777	July 24, 1905	A. L. C. Atkinson
4	Koolau, Maui.....	Koolau and Hamakualoa	Maui	42,969	30,230	12,739	Aug. 24, 1905	"
5	Halelea.....	Halelea	Kauai	37,500	10,990	26,510	Aug. 24, 1905	
Total for the year ending December 31, 1905.....				190,469	101,443	89,026		
6	Kealia.....	Puna	Kauai	9,935	7,385	2,550	Mar. 9, 1906	"
7	Ewa.....	Ewa, Waianae and Waialua	Oahu	28,350	5,131	23,399	Mar. 9, 1906	"
8	Honouliuli.....	Kona	Hawaii	665	665	.....	April 4, 1906	
9	Kau.....	Kau	Hawaii	65,850	59,618	6,232	Aug. 2, 1906	G. R. Carter
10	Waipaeakai.....	Waianae	Oahu	3,257	3,150	107	Sept. 7, 1906	"
11	Lualualei.....	Waianae	Oahu	3,743	3,743	.....	Nov. 30, 1906	"
12	Hana.....	Hana	Maui	14,825	13,767	1,058	Nov. 30, 1906	"
Total for the year ending December 31, 1906.....				126,825	93,479	33,346		
13.	Na Pali-Kona.....	Na Pali and Kona.....	Kauai	60,540	40,650	19,890	June 12, 1907	A. L. C. Atkinson
Total for the year 1907.....				60,540	40,650	19,890		
14	West Maui.....	Lahaina, Kaanapali and Waialuku	Maui	44,440	19,105	25,335	April 21, 1908	W. F. Frear
15	Makawao.....	Hamakuaopoko	Maui	1,796	1,796	.....	April 21, 1908	"
16	Waiaha Spring.....	Kona	Hawaii	193	193	.....	April 21, 1908	
Total for the year ending December 31, 1908.....				46,429	21,094	25,335		
Grand Total December 31, 1908.....				444,116	273,912	170,204		

FOREST RESERVES, TERRITORY OF HAWAII.

Arranged by Islands and Counties.

(Corrected to December 31, 1908.)

No.	Name.	District.	Island.	Total Area Recom- mended to be Reserved.	Area Gov- ernment Land.	Area Private Land.	Date of Proclamation.	Proclamation Signed by
COUNTY OF KAUAI.								
				Acres.	Acres.	Acres.		
5	Halelea.....	Halelea	Kauai	37,500	10,990	26,510	Aug. 24, 1905	A. L. C. Atkinson
6	Kealia.....	Puna	Kauai	9,935	7,385	2,550	Mar. 9, 1906	"
13.	Na Pali-Kona.....	Na Pali and Kona	Kauai	60,540	40,650	19,890	June 12, 1907	"
	Total.....			107,975	59,025	48,950		
COUNTY OF OAHU.								
				913	913	.....	Nov. 10, 1904	G. R. Carter
1	Kaipapau.....	Koolauloa	Oahu	28,550	5,151	23,399	Mar. 9, 1906	A. L. C. Atkinson
7	Ewa.....	Ewa, Waianae and Waialua	Oahu	3,257	3,150	107	Sept. 7, 1906	G. R. Carter
10	Waianae.....	Waianae	Oahu	3,743	3,743	.....	Nov. 30, 1906	"
11	Luahaulei.....	Waianae	Oahu	.....	.....	.....
	Total.....			36,463	12,957	23,506		
COUNTY OF MAUI.								
				42,969	30,230	12,739	Aug. 24, 1905	A. L. C. Atkinson
4	Koolau, Maui.....	Koolau and Hamakualoa	Maui	14,825	13,767	1,058	Nov. 30, 1906	G. R. Carter
12	Hana.....	Hana	Maui	.....	.....	.....
14	West Maui.....	Lahaina, Kaanapali and Waialeale	Maui	44,440	19,105	25,335	April 21, 1908	W. F. Frear
15	Makawao.....	Hamakualoko	Maui	1,796	1,796	.....	April 21, 1908	"
	Total.....			104,030	64,898	39,132		
COUNTY OF HAWAII.								
				18,940	16,333	2,607	Dec. 23, 1904	G. R. Carter
2	Hamakua Pali.....	Hamakua	Hawaii	110,000	60,223	49,777	July 24, 1905	A. L. C. Atkinson
3	Hilo.....	Hilo	Hawaii	665	665	.....	April 4, 1906	"
8	Honouliuli.....	Kona	Hawaii	65,850	59,618	6,232	Aug. 2, 1906	G. R. Carter
9	Kau.....	Kau	Hawaii	193	193	.....	April 21, 1908	W. F. Frear
16	Waialua Spring.....	Kona	Hawaii	.....	.....	.....
	Total.....			195,648	137,032	58,616		
	Grand Total			444,116	273,912	170,204		

RESERVES PROJECTED.

It usually happens at the end of any given period that besides the forest reserves actually set apart there are other forest reserve projects pending final action. In the present instance three projects are practically at the point of completion, the Kohala Mountain Forest Reserve on Hawaii, 27,160 acres, and the Lihue-Koloa and the Moloaa Forest Reserves, both on Kauai, respectively, 29,260 and 5,670 acres. These reserves are now before the Board for final consideration. It is expected that they will be set apart early in the coming year. Other forest reserve projects await the completion of the technical descriptions of boundary or require additional field work before being reported on to the Board.

At the request of this office a comprehensive survey has been made by the Territorial Government Survey of the government forest lands in South Kona, Hawaii. This survey will serve as a basis for a systematic classification of those lands, as well as for the setting apart of portions of them as a forest reserve. It is decidedly a part of the policy of the Board of Agriculture and Forestry to stand for the better classification of all lands owned by the government. Indeed, this is felt by all those who have seriously studied the local land problem to be one of the most obvious ways of relieving the present unsatisfactory situation. The survey of the South Kona lands is a step in the right direction.

FOREST AREAS.

Apropos of the creation of additional forest reserves, an estimate of the area now under forest in the Territory of Hawaii, made recently from the best data available, may be of interest. The forest areas are classified according to the three main Hawaiian forest types, the Koa and Ohia forest, the Mamani forest on the higher slopes of Mauna Kea on Hawaii, and the Algaroba forest at the lower elevation on the leeward side of each island. The areas are as follows:

Island.	Koa and Ohia.	Mamani.	Algaroba.	Total
	Acres.	Acres.	Acres.	Acres.
	(Approximate)			
Kauai	148,115	.....	8,000	156,115
Oahu	111,271	.....	23,400	134,671
Molokai	39,000	.....	10,000	49,000
Lanai	2,300	.....	.....	2,300
Maui	115,896	.....	12,000	127,896
Hawaii	758,418	63,500	7,000	828,918
Total	1,175,000	63,500	60,400	1,298,900

The areas given include both government and privately owned land. All of the forest reserves so far set apart are in the Koa and Ohia forest type. Out of the area covered by this type of forest—approximately 1,175,000 acres—there have already been set apart 444,116 acres, of which 61 per cent. is government land. When the chain of projected forest reserves is complete it is estimated that about 750,000 acres will have been set apart as forest reserves, of which about 70 per cent. will belong to the government. For a further description of the forest types present in Hawaii reference may be made to the Report of the Territorial Conservation Commission (in Appendix A, Report of the Committee on Forests) which appears as an appendix to this annual report, in another part of the present publication.

UNDERLYING PRINCIPLES OF THE HAWAIIAN FOREST POLICY.

In a subject so intimately connected with the continued welfare of the Territory as is forestry, it is well that there should be a clear understanding of the principles on which the forest policy of the Territorial Government is based. An annual report gives the opportunity for a restatement of the "reasons why." Perhaps it may not be out of place once again to outline the essential facts.

There are in Hawaii two main classes of forest land, which for the sake of convenience have been termed the "water-bearing forest" and the "commercial forest." The water-bearing forest is situated for the most part in the windward districts and covers the water sheds and catchment basins of the streams that are needed for irrigation, power development and other economic uses. The chief value of this forest is that it protects the headwaters of these streams. Its most important product is water, and the treatment indicated for it is therefore the one which will best serve to produce the largest quantity of water.

This class of native Hawaiian forest belongs to what is known as the "rain-forest" type, common in the tropics. To render to the full its beneficial service as a conservator of water, it is essential that the forest cover be kept strictly intact, for owing to its character and composition the Hawaiian forest is easily damaged by the inroads of cattle and other enemies. The method of management best adapted to secure the result desired with this class of forest is to keep it as a "protection forest," from which men and animals are strictly excluded. Only by so managing it can it be made to yield permanently the largest share of its most valuable product, water. All but one of the sixteen forest reserves so far set apart are in the water-bearing forest class. They are therefore to be considered and treated as protection forests.

The other main class of Hawaiian forest, the commercial forest, is found for the most part in the districts on the leeward side of the Island of Hawaii, where from the nature of the topography and the remarkable porosity of rock and soil there are no permanently running streams and only occasional springs. In such districts it is obvious that the protection of water sheds does not figure. Consequently the chief value of the commercial forest lies in the wood and timber which it can be made to produce. Fortunately over a considerable portion of the commercial forest reproduction can be secured through natural means, so that successive crops of valuable timber can be obtained, provided the forests are managed in accordance with the dictates of practical forestry.

Important as the commercial forest is, it should be clearly borne in mind that in Hawaii the water-bearing forest is far and away the more important of the two classes, and that wherever it—the water-bearing forest—occurs it should, because of its relation to the economic development of the Territory, not only be carefully protected but so managed that it may be of the greatest use possible.

THE APPLICATION OF THE PRINCIPLES.

The practical application of the principles above set forth is—and the point should be urged strongly—that until provision is made for adequately protecting the forest reserves from injury by fire, animals and trespass, the Hawaiian forests cannot be made to serve to the full the objects for which the reserves are created. The essential needs are money for fencing such stretches of the reserve boundaries on government land as cannot be provided for through fencing provisions in the leases of adjoining government lands; a fund for fighting forest fire on government land; and an appropriation sufficient to permit the employment of forest rangers to protect the reserves from fire, to see that the boundaries are maintained and respected, to prevent trespass of animals and men, and in general to give to the forest the care that it requires to be made of the greatest service.

What has so far been done is practically to provide a skeleton of forest reserve administration. The defining of boundaries, the reports and recommendations, the official proclamation of the area as a reserve are all necessary steps essential to the creation of a legal forest reserve. As such they justify the time that has to be spent on them. But no one understands more clearly than do the members of the Division of Forestry that it takes more than reports and the coloring in of areas on a map to make an efficient forest reserve. To make the forest reserve system of

Hawaii truly effective requires men as well as maps. The intimate relation between forest protection and the continued economic welfare of the Territory is apparent. It is because I believe the need is vital that I urge so strongly that provision be made for an adequate force for forest reserve administration.

The problem of what should be done is simple. The most important product of the Hawaiian forest reserves is water. To get the largest quantities of water for the longest time and with as little fluctuation as possible requires in the case of most Hawaiian streams that the forest cover on the catchment basin be kept strictly intact, and that where it has once been opened up by cattle or through other causes, the forest cover shall be replaced and thereafter protected and maintained.

Forest Rangers.

Specifically three things are particularly needed; forest rangers, fences for certain portions of forest reserve boundaries, and a fund for fighting forest fires on government land.

The chief duties of forest rangers would be to protect the forest reserves from trespass by stock and from damage by forest fire. To accomplish this it is necessary that the reserves be properly enclosed and that the fences be maintained and kept in repair. To facilitate patrol duty and to enable the rapid transfer of men in case of fire, trails should be built and kept in repair. Added to these duties the rangers in certain reserves would have to capture or destroy wild cattle, goats and other animals at large in the forest; in others they would be required to oversee forest planting.

Incidental to more important uses, trails in certain of the forest reserves would enable the use of the forests by the people as parks. Especially is this true in localities noted for the beauty or picturesqueness of the scenery, or otherwise of interest to visitors. Examples are the Iao Valley in the West Main Forest Reserve on Maui, and Konahuanui Peak in the projected forest reserve above Tantalus, back of Honolulu. Such use of the forest would in no way interfere with the objects of the reserve, but on the contrary by familiarizing more people with the forests, would tend to bring home to a larger number the intimate relation that forest protection bears to the life of the Territory.

For an at all adequate administrative organization, twelve forest rangers are imperative. This number is meagre in view of the area to be covered and the nature of the work to be done, but twelve efficient men could do much. Figuring on established and prospective forest reserves, with this force the districts would be as follows:

Hawaii...	Puna and Hilo Districts	1
	Kohala and Hamakua Districts	1
	Kau District	1
	Kona District	1
Maui....	West Maui	1
	Koolau and Hana Districts	1
Molokai.....	.....	1
Oahu....	Waianae Mountains	1
	Koolau Range	1
	Tantalus and Vicinity	1
Kauai....	Na Pali, Kona and South Puna Districts.....	1
	Halelea, Koolau and North Puna Districts.....	1
Total		12

The absence of forest rangers reacts unfavorably on the forests of Hawaii in two ways. First, it is now impossible to take effective measures toward suppressing trespass by stock and preventing damage by forest fire. Second, until the Board of Agriculture and Forestry can offer at least an equally good administration of the forest reserves, private corporations and individuals will be slow in turning over their forest lands to the Board for management. To secure the best results from forests of the type common to the Hawaiian forest reserves requires that all the lands in any given reserve be under the control of one central authority. It would be well if the title to all the lands in all the established forest reserves could be transferred to the Territorial Government. But as the Territory is not likely for a considerable time to be in a financial position that would make such a consummation possible, there is the more need to bring about a condition of things that shall lead to a transfer of the management of the privately owned tracts to the Territorial forest officials.

Forest Reserve Fencing.

Wherever possible the boundaries of the forest reserves are made to follow natural barriers. But there are numerous places where fencing is required. In many instances a short stretch of fence will protect considerable areas of forest. Money is needed to fence such portions of forest reserve boundaries across government lands. Often it is not possible to make the building of the fence a condition of the lease of adjoining government land, so that in the absence of a special fund it is impossible to get the work done at all. This results in damage from stock and in other injury to the forest.

Forest Fire Fund.

It ought not to require argument to show the necessity for money with which to fight forest fires on government land. Under the present law owners or lessees of private or of government lands can be held responsible for fires that spread to other lands and so can be made to take active steps to combat fires. But there is no way in which payment can now be made for fighting fire on unleased land owned by the government. As much of the land in the forest reserves is in this case, the need is one of pressing importance. The coming session of the Legislature ought not to end without provision for a special fund to be used in emergencies.

H. S. P. A. RESOLUTION.

In this connection it may not be out of place to quote a resolution unanimously adopted at the annual meeting of the Hawaiian Sugar Planters' Association, held in November, 1908, in that it voices the sentiment of the strongest commercial organization in the Territory.

"Resolved, That in the opinion of the Hawaiian Sugar Planters' Association the work of forest protection and extension is of the highest importance to the agricultural interests of this Territory;

"That in the opinion of this Association the time has arrived when liberal appropriations should be made for such protection and extension, and we hereby petition the Legislature to make liberal specific appropriations for forest fencing; for rangers to inspect and protect the forests from fire, depredation and trespass; and for replanting with trees areas which have been heretofore denuded of forest."

DAMAGE BY GOATS.

Under the subject of Forest Reserves attention should again be called to the serious damage resulting to the forests from the depredations of wild goats. In my report for 1907 I recommended that Act 116 of the Session Laws of 1907, requiring the payment of a hunting license fee, should be so modified as to permit the free shooting of wild goats in established forest reserves. By a proper system of permits, issued by the District Forester or other local official, it could easily be arranged so that the privilege could not be abused. This amendment to the law is one that I believe should unquestionably be made.

FOREST EXTENSION.

The second main branch of work carried on by the Division of Forestry is Forest Extension. Its aim is to encourage tree planting. This it seeks to do by the systematic introduction of desirable trees and shrubs new to the Territory, by giving advice to persons desiring it on what, where and how to plant, and by furnishing seed and seedling trees at cost price from the Government Nursery.

The Section of Forest Extension is under the direct charge of Mr. David Haughs, Forest Nurseryman. For a statement of what has been accomplished during the past year, Mr. Haughs' report should be consulted. It sets forth briefly the essential facts and makes evident that this phase of the work of the Division of Forestry is constantly broadening in scope and developing in importance.

EXPERIMENTAL GARDENS.

It is unnecessary to repeat the points brought out in Mr. Haughs' report, but special mention should be made here of the establishment of an Experimental Garden in Makiki Valley, where will be set out and kept under observation the plants resulting from seed received in exchange from foreign sources and started in the specially constructed germination houses at the Government Nursery. As the result of the establishment of the systematic exchange of seed, inaugurated on a large scale in 1907 with over one hundred botanic gardens and other similar institutions throughout the world, many kinds of seed have been received. There can be no question that when these new plants come to be properly tested there will be found among them not a few desirable additions to our introduced flora. It follows, of course, that the plants found to be desirable will be propagated and eventually distributed.

In connection with the work of plant introduction mention should also be made of the establishment of an experimental sub-garden at Kalaheo, on Kauai. To protect a reservoir site in the upper portion of the Kalaheo Homestead Tract a couple of lots had been reserved from entry and turned over to the Department of Public Works. This area, "Papapaholoholo," was in turn transferred to this Department in order that it might be used for tree planting. At the request of this office Mr. Walter D. McBryde, the local District Forester, an enthusiastic tree planter who has done a very considerable amount of tree planting on adjoining private lands, consented to oversee the planting and direct the work locally. Accordingly the area has been fenced and one laborer employed to work under Mr. McBryde's supervision. In

the garden so made it is the intention to plant out such of the newly introduced trees and shrubs as appear suitable for use at the elevation and situation of Kalaheo.

New trees and shrubs are now sent out for experimental planting to a number of persons in various parts of the Territory who are interested in tree planting, but for the most part, naturally enough, there is a disinclination to take much trouble with new plants until it is known definitely whether or not they will do well and be of use in this Territory. In order to test more thoroughly the newly introduced plants and in view of the difficulties of local transportation, I believe it would be well to have a number of sub-gardens in different parts of the Territory, where trees new to the islands could be tried under varying conditions of elevation, soil and exposure and from which seedlings of the trees in common demand could be distributed for forest and other planting. Data obtained from careful observations made from time to time at such sub-stations as Kalaheo would supplement those obtained at the Makiki Garden and in the end would prove of decided benefit to the people of the Territory.

The main objection to the establishment of such sub-stations is the cost. Unless the work can be carried on under the supervision of a capable and suitably trained person satisfactory results cannot be expected. The matter is mentioned at this time in that it is a desirable line of work for the Division of Forestry to engage in should at any time means to carry it on be made available.

PLANT INTRODUCTIONS OF SPECIAL IMPORTANCE.

In connection with this subject special attention should be called to that section of the Forest Nurseryman's report that tells of the successful introduction into Hawaii, through the coöperation and assistance of this Division, of two plants of high economic importance, Mocha Coffee and Esparta, a grass valuable for weaving and other work. Without the special facilities possessed by the Division of Forestry for the handling of difficultly propagated plants it would have been impossible to give the seed of these plants the necessary treatment.

EXPERIMENTAL TREE PLANTING ON THE HIGH MOUNTAINS.

In 1907 there was secured from the United States Forest Service an allotment of \$2,000.00 for experimental tree planting on the upper slopes of Mauna Kea and Haleakala, above the upper limit of the native Hawaiian forest. This allotment was subsequently cancelled by direction of the Comptroller of the United

States Treasury. But in 1908 an equal amount was again allotted. At the end of the calendar year arrangements are complete for carrying the plans into effect. The field work will start early in 1909.

Briefly, the object of this experiment is to try at elevations of from six to ten thousand feet valuable timber trees from the temperate zone, primarily conifers, with the expectation that some among those tested will be found to be adapted for local use. It is hoped that eventually, as a result of this experimental planting, a forest can be established on the now unproductive upper slopes of these two mountains.

The segregation of waste land and its retention by the government when old leases of government land run out and new leases come to be made has consistently been a part of the policy advocated by the Board of Agriculture and Forestry. The present instance shows the advisability of this policy. For if, as is reasonably to be expected, valuable trees can be made to grow on this otherwise waste upland, it is certainly advisable that the area be in the control of the Territory. Under the old method of leasing large government lands as a whole, the waste areas were thrown in with the better land, swelling the acreage but adding no real value to the leasehold. As it is now each part of the land can, as it is needed, be put to the use for which it is best adapted.

PROGRESS IN FOREST PLANTING.

That forest planting is increasing in Hawaii is shown by the following tabulated record made up from answers to a schedule of inquiries that was sent out to each of fifty-two sugar plantations and to thirty-six stock ranches. The table shows that twenty-eight sugar plantation companies are now engaged more or less extensively in tree planting, usually on waste land; of this number all but one began planting earlier than 1908; almost all expect to continue the work in 1909. Of the sixteen ranches that responded nine are in the list of tree planters. All but one began the work earlier than 1908. All expect to continue during 1909.

As many of the companies doing tree planting work have not kept complete records, such a table as this is, of course, only an approximation, but it may safely be said that in every case it errs on the side of being conservative. The area and number of trees actually planted are therefore greater than the figures here given, especially for the work done prior to 1908.

In all during the past year, 325,824 trees have been planted by the plantation companies reporting; by the ranches 172,853; making a grand total of 498,677.

*Tree Planting in Hawaii Now Being Done by Sugar Plantation
Companies and Stock Ranches.*

Kauai.

Name of Corporation	Total Area Planted Acres.	Area Planted in 1908 Acres.	Total No. Trees Planted	Trees Planted in 1908	Began Planting	Intend to Plant in 1909
Grove Farm, G. N. Wilcox, Prop.	100	5	40,000	3,000	1906	Yes
Lihue Plantation Co.	1,100	50	.....	20,000	1882	Yes
Mahee Sugar Co.	..	..	*7,500	*4,000	1907	Yes
McBryde Sugar Co.	..	..	62,648	16,925	1900	Yes
	<u>1,200</u>	<u>55</u>	<u>110,148</u>	<u>43,925</u>		
McBryde Homesteads (under direction of Mr. Walter D. McBryde)	25	6	65,000	15,000	1904	Yes
Total	<u>1,225</u>	<u>61</u>	<u>175,148</u>	<u>58,925</u>		

Oahu.

Name of Corporation	Total Area Planted Acres.	Area Planted in 1908 Acres.	Total No. Trees Planted	Trees Planted in 1908	Began Planting	Intend to Plant in 1909
Ewa Plantation Co.	..	..	.....	10,972	1907	Yes
Honolulu Plantation Co.	10	..	2,000	.....	1899	Yes
Laie Plantation	..	..	5,000	2,000	1899	Yes
Kahuku Plantation Co.	..	..	*30,000	*10,000	1903	Yes
Waianae Company	26	4	11,562	1,794	1906	Yes
	<u>36</u>	<u>4</u>	<u>48,562</u>	<u>24,766</u>		
Kaneohe Ranch Co.	10	..	10,500	10,500	1908	Yes
Oahu Railway & Land Company Ranch Department	..	..	25,000	3,000	1898	Yes
Maunawili Ranch	300	57	25,120	4,536	1896	Yes
	<u>310</u>	<u>57</u>	<u>60,620</u>	<u>18,036</u>		
Total	<u>346</u>	<u>61</u>	<u>109,182</u>	<u>42,802</u>		

Maui.

Name of Corporation	Total Area Planted Acres.	Area Planted in 1908 Acres.	Total No. Trees Planted	Trees Planted in 1908	Began Planting	Intend to Plant in 1909
Kaeleku Sugar Company	3	...	1,500	300	1906	Yes
Maui Agricultural Co.	*700	88	*400,000	151,000	1900	Yes
Olowalu Company	..	..	200	75	.....	Yes
Wailuku Sugar Co.	*30	*30	4,478	4,478	1908	Yes
Hawaiian Commercial & Sugar Company	..	..	34,629	.....	1902	Yes
	<u>733</u>	<u>118</u>	<u>440,807</u>	<u>155,853</u>		
Cornwell Ranch	..	..	1,000	.....	1906	Yes
Haleakala Ranch	180.25	19.25	106,830	19,665	1900	Yes
Maui Agricultural Company's Ranch	*100	30	*80,000	22,000	1906	Yes
	<u>280.25</u>	<u>49.25</u>	<u>186,830</u>	<u>41,665</u>		
Total	<u>1,013.25</u>	<u>167.25</u>	<u>627,637</u>	<u>197,518</u>		

* Approximate figure.

Hawaii.

Name of Corporation	Total Area Planted	Area Planted in 1908	Total No. Trees Planted	Trees Planted in 1908	Began Planting	Intend to Plant in 1909
	Acres.	Acres.				
Hakalau Plantation Co.....	...	...	*3,000	500	1906	Yes
Halawa Plantation Co.....	3	1	.....	2,000	1890	Yes
Hawaiian Agricultural Co.....	25	5	16,000	3,000	1905	Yes
Hawi Mill & Plantation Co.....	8	...	.....	2,000	....	No
Hilo Sugar Company.....	...	...	2,570	120	....	Yes
Hutchinson Sugar Plantation Co.....	...	4.5	.....	1,360	....	Yes
Kohala Sugar Co.....	*250	*23	*200,000	*18,000	1896	Yes
Kukaiau Mill Co.....	...	...	*4,000	2,500	1907	Yes
Laupahoehoe Sugar Co.....	4	...	200	.....	(Ornament only)	
Niulii Plantation .....	...	...	6,000	1,000	....	Yes
Olaa Sugar Co.....	...	...	1,000	1,000	....	No
Pacific Sugar Mill.....	...	Extensive planting in past years.				
Paauihau Sugar Plantation Co...	115	30	115,275	52,200	1891	Yes
Peepeekeo Sugar Co.....	6	...	.....	2,000	1905	Yes
Puakea Plantation Co.....	...	...	2,000	600	1900	Yes
	411	63.5	350,045	86,280		
Kukaiau Plantation Company's Ranch	517	194	278,952	112,952	1894	Yes
Parker Ranch .....	...	...	*15,000	.....	1903	Yes
Puuwaawaa Ranch .....	...	...	1,000	200	....	Yes
	517	194	294,952	113,152		
Total	928	257.5	644,997	199,432		

Summary.

Island.	Plantations.		Ranches.		Totals.	
	Total Trees Planted.	Trees Planted 1908.	Total Trees Planted.	Trees Planted 1908.	Total Trees Planted.	Trees Planted 1908.
Kauai	175,148	58,925	.....	.....	175,148	58,925
Oahu	48,562	24,766	60,620	18,036	109,182	42,802
Maui	440,807	155,853	186,830	41,665	627,637	197,518
Hawaii	350,045	86,280	294,952	113,152	644,997	199,432
Total	1,014,562	325,824	542,402	172,853	1,556,964	498,677

A LOOK AHEAD.

The planting of practically half a million trees during one year is a record decidedly worth while. It shows that the men in the Territory who have most occasion to use wood are awake to the fact that the sources of supply are diminishing and that they are preparing to meet the need by providing a local supply. But encouraging as is the start made, it is only a small part of what ought to be done.

The investigations of the Section of Forests of the National Conservation Commission—the results of which have but lately been made public—show that the amount of wood annually used on the American mainland is $3\frac{1}{2}$ times the amount yearly produced by the forests. The uses of wood are constantly increasing and the prices of all wood products are steadily going up. Wasteful methods, coupled with ever-enlarging demands, have now

brought things to a point where a timber famine is inevitable. How severe and of how long duration this wood famine will be depends very largely on how soon the annual production of wood is made to balance the annual consumption. The remedy lies in the better management of the forests, in lessening the waste that occurs all the way from the stump to the consumer, in prolonging the life of wood through preservative treatments, in stopping loss from forest fires, and most of all, in forest planting. As a result of the lessening supply of wood some of the above suggested remedies are coming to be applied, but it is too late to avert the impending crisis. The only real solution, the only way to get at the root of the difficulty, is to make production equal out-go.

Hawaii is in no wise exempt from the perplexities that will follow the coming scarcity of timber. Indeed this discussion is particularly pertinent here in that so large a portion of the wood products used locally, and practically all of the construction timber used in the islands, is imported.

The reports of the United States Department of Commerce and Labor give the imports of timber, boards and plants into Hawaii for the fiscal year ending June 30, 1907, as 30,603,000 feet, board measure; with a value of \$565,425.00. For the fiscal year ending June 30, 1908, the corresponding figures are 29,191,000 feet, board measure, and \$477,422.00. These figures need no further comment. But it may be said that those persons who start forest plantations now will be the best prepared to meet the additional pressure when it comes, as it surely will, within a few years.

The needs for railroad ties, fence posts, fuel and construction timber can all be met, at least in part, by trees that can be grown in the islands. The Division of Forestry stands ready to advise what kinds should be planted to obtain certain results, and to show when, where and how to go about the work. Much good work has been done in 1908. It is for the far-sighted to make 1909 a year phenomenal for its tree planting.

RECOMMENDATION.

The greatest drawback at present to a more rapid extension of tree planting in Hawaii is that many persons who otherwise would plant trees hesitate because they can not find out just what returns may reasonably be expected under local conditions. This is information that should be available and which it is the business of the Division of Forestry to obtain. The necessary data can be got from the systematic measurement of planted groves of varying ages. There is enough planted forest in Hawaii to give all the figures required, but it needs technically trained men to do the work. A start in this direction was made by the Division of

Forestry two years ago, but the pressure of other work, with a staff of only two men, has prevented its being continued.

What the Division of Forestry needs is another assistant—a man technically trained in the profession of forestry, who has also had practical experience. The calls that are made on the Division in this and in allied branches of forest work more than justify the necessary outlay in salary, for the benefit that would result from the increased efficiency of the Division of Forestry would be a good return on the investment.

I accordingly recommend that in the estimates for the next fiscal period provision be made for the appointment of a technically trained assistant in the Division of Forestry.

TREE PLANTING UNDER A GOVERNMENT LEASE.

Pertinent for consideration under Forest Extension is a new departure in forest policy made during 1908, in the requirement in a lease of government land for grazing purposes, that a definite number of trees be planted on specified portions of the tract. The lands in question are situated in the District of Hamakua, Island of Hawaii, and the leases (Nos. 623, 625 and 626) are made to the Kukaiau Plantation Company, of which Mr. Albert Horner is Manager. The lands required to be planted were formerly under forest, but owing to a variety of causes, chief among which were the forest fires of 1901, the original forest has now completely disappeared and been followed by a dense cover of rank growing grass that effectually prevents forest reproduction.

After a thorough study of the whole situation on the ground the Superintendent of Forestry reported adversely on the proposal to have this area set apart as a forest reserve, in that, under the conditions that had come to exist, and in view of the fact that there were no permanently running streams to be protected, the land could more advantageously be used for other purposes than forest. The object of the present planting then is not the reforestation of the area, but its improvement through the planting of groves of trees that shall serve, when safely established, as stock shelters in connection with the ranch and ultimately as a local supply of wood and timber.

Incidentally, if then so desired, the groves now established could be used a score or more years hence as seed spots for the extension of a forest cover through natural reproduction. What is more likely is that by that time the land can be used for some more intensive form of agriculture than grazing, through the gradual development of the district, made possible through improved facilities of transportation.

The tree planting clauses of the leases provide that Eucalyptus

trees shall be planted at the rate of 40 to the acre—the actual planting, however, to be in groves, with the trees 8 feet apart—and that that number in good condition shall be maintained during the term of the (twenty-one year) lease. The proposal that a tree planting clause be inserted in the leases originated with Mr. Horner, who following in the footsteps of his father, the late John M. Horner, has for a number of years been actively engaged in tree planting on the ranch. The trees to be used are Eucalypts, at first mainly Blue Gum. But it is provided that other species may be substituted on approval by the Superintendent of Forestry.

The precedent established in this instance will unquestionably lead to the insertion of similar clauses in other leases of grazing land elsewhere in the Territory, for there are many localities where tree planting which could not otherwise be undertaken can thus be provided for. In some cases this method of planting can be used as a step to the reforestation of a denuded area. In any event the value of the land to the government would be increased through the presence of groves of thrifty trees.

MISCELLANEOUS FOREST WORK.

In addition to its two main lines of forest work—forest reserve administration and forest extension—the Division of Forestry is charged with the duty of promoting the forest interests of the Territory in other ways. With the development of the lumber industry in Hawaii, brought into especial prominence during the past two years through the operations of the Hawaiian Mahogany Lumber Company in Puna, Hawaii, attention has been called to the commercial side of forestry and to the possibility, in certain districts of the Territory, of deriving a revenue from the government forests.

It has already been made clear in this report that there are two classes of forest in Hawaii—the water bearing forest and the commercial forest—and that radically different treatment is required to make each one serve its purpose to the best advantage. The policy of the Territorial government in protecting the more important class—the water bearing forest—through the creation of forest reserves, managed as “protection forests,” has also been fully discussed.

It is equally the policy of the administration, in districts where the Territorial forests are of the commercial class, to make the forest revenue producing by exploiting it in accordance with the methods of practical forestry. But in forestry there is no hard and fast rule that can everywhere be followed. On the contrary each case must be decided on its own merits. Especially is this true in Hawaii where lumbering is a new departure and where the

absence of local experience makes the problem of the best subsequent treatment of the tract to be cut over, a matter that should have the most careful attention.

FOREST MANAGEMENT.

The conditions obtaining in the District of Puna, on the Island of Hawaii, are such on general principles as to justify lumbering. There are and can be no running streams. Consequently the question of watershed protection is not a factor. The forest is essentially of the "commercial class."

But this in itself does not predicate that the present is necessarily the best time at which to lumber the Puna forests. The condition of the forest, the stumpage prices to be got now and that may be expected in the future, the methods by which the work in the woods would be done, and the use to which the land would be put after lumbering, are all factors that, with others, enter into the problem. To be prepared intelligently to deal with the Puna problem, especially in view of an application from the Hawaiian Mahogany Lumber Co. for stumpage rights on the government forest lands in Puna, the Superintendent of Forestry made two visits to the district in 1908, respectively in September and December. His report thereon is now in course of preparation. It will be made public early in 1909 and will contain a statement of facts, with specific recommendations.

The Hawaiian Mahogany Lumber Company.

As a matter of record it may be noted here that the plans of the Hawaiian Mahogany Lumber Company have been somewhat slow in developing, due to various unforeseen obstacles that have arisen from one cause or another. Lumbering is a new industry in Hawaii and it is not surprising that there should be some difficulty in getting it under way.

A large modern saw mill has been erected by the Company at Pahoa, Puna, Hawaii, and operations were begun there in September. On December 1, 1908, the first regular shipment of ties for the Santa Fé Railway was dispatched from Hilo in the schooner Emily F. Whitney. The lot consisted of 20,058 standard Ohia Lehua ties. It will be recalled that the contract with the Santa Fé Railway made in September, 1907, calls for 500,000 ties annually for five years.

Fifteen thousand feet of Ohia lumber was sent to California in November in an attempt to find a market for the by-product resulting from the waste that comes in squaring rough logs for tie purposes. The Lumber Company plans to work up some of this

material as telephone insulator pins and brackets, for which purpose Ohia is excellently well adapted.

In order to concentrate all its energies on logging Ohia for ties, the Company has temporarily discontinued its operations in the Koa forests.

Utilization of the Commercial Forest.

The inauguration of the lumber industry in Hawaii points to the need for a careful investigation of all the forests owned by the Territory in the leeward districts on the Island of Hawaii that belong to the commercial forest class. In several cases already, applications have been made for logging rights. Others are sure to follow. The Territorial officials should be in touch with the exact conditions so as to be able to act without delay. In this same connection the Division of Forestry is in frequent receipt of requests from owners of private forest belonging to the commercial class, for advice on how best to manage their forest properties.

Because forests react on the life of a community in so many and in so diverse ways, the wise management of the forests of any given state is a matter of concern not alone to those persons who own the forests but to all the people. A large proportion of the forest area in this Territory is now and will remain in private ownership. But it is well within the province of the government to take such steps as it reasonably may to induce private owners to manage their forest properties wisely.

To meet requests for advice on these matters is consequently a distinct part of the forest policy of the Territory and should form a regular section of the work of the Division of Forestry. It is as much a part of forestry to cut, as to plant trees. In either case there is a right way and a wrong way to go about the work. The purpose of the Division of Forestry in its offer of advice and assistance is to help private owners to manage their forests, be they natural or artificially planted, in the way that will make them of the greatest service.

Supervision of Lumbering.

Should it later be found advisable to grant logging rights in certain of the government forests, it follows that the work would be done in accordance with careful regulations prepared by this department, executed under strict supervision.

Both the investigations and the subsequent administrative inspection of forests of the commercial class are work that require the services of men technically trained in forestry. Mention has

already been made, in connection with Forest Extension, of the need of another assistant in the Division of Forestry. The increase in the demands made on the Division under forest management is an added reason why such a man should be provided.

PUBLICITY IN FOREST WORK.

Another way in which the Division of Forestry is of service is by taking advantage of all convenient opportunities to bring to the attention of the people of the Territory statements in regard to the principles of forestry, reports of work in hand, and the reasons why certain policies are advocated and pursued. When so large a part of the forest work done in Hawaii is and must be carried out under private auspices it is advisable that a share of the attention of the Territorial Division of Forestry be given to making better known the precepts of forestry and the reasons that underlie them. The man who cares for a tract of native forest intelligently, or who starts a grove of thrifty trees, benefits not only himself but an ever-widening circle of his neighbors throughout the Territory. In view of the close relation between forest protection and the continued success of agriculture in Hawaii, and because of the steadily growing demand for wood of all kinds, it is not only desirable—it is essential that the citizens of Hawaii be brought to understand and practice forestry. It is for this reason that reports are written and speeches made. The development of a better understanding of what forestry is and what it does justifies the time and labor expended.

During 1908 in furtherance of this idea two popular lectures on forestry were given in the spring at the College of Hawaii; papers telling of the progress of forestry were prepared and read before the annual meeting of the Hawaiian Sugar Planters' Association and of the Hawaiian Rubber Growers' Association in November; and numerous reports and other contributions written for the Hawaiian Forester and Agriculturist and for the various newspapers. In January, 1908, an exhibit illustrating the work of the Division of Forestry was made at the Third Annual Exhibit of the Hawaiian Poultry Association.

Whenever a forest reserve is set apart the reasons for its creation are outlined in the report of the Superintendent of Forestry. These reports, with the recommendations of the Committee on Forestry, are always published in full in the Hawaiian Forester and Agriculturist, the official organ of the Board of Agriculture and Forestry, in which magazine are also to be found special contributions and other miscellaneous reports on forest subjects. Perhaps deserving mention here is an exhaustive report on "The Forest Situation in Hamakua," published in the Forester for

April, 1908, in which are stated at length the reasons why it is not considered wise at this time to recommend that an extensive forest reserve be created in the Hamakua District, Hawaii. That report also includes a discussion of the much mooted question of the influence of forest on rainfall, with especial reference to the forests of Hamakua. The report was the result of several visits to Hamakua, and immediately followed a final investigation, made in February, 1908.

TERRITORIAL CONSERVATION COMMISSION.

The Conference of the Governors.

Mention was made in the opening paragraphs of this report of the important role played by the Conference of the Governors in the history of forestry in the United States in 1908. It is of interest to record here that Hawaii had a direct part in that memorable gathering. In response to the invitation of President Roosevelt, Governor Frear attended the Conference and took with him as his three "Advisors," Honorable W. O. Smith, Mr. Alonzo Gartley, and the Superintendent of Forestry.

To have attended the Conference of the Governors and not to have come back to one's regular duties with a broader outlook and with renewed enthusiasm would be an impossibility. The uplift of that meeting will ever remain as a powerful incentive to all who were fortunate enough to have a part in it.

During my stay in Washington I was able to get closely in touch with phases of the recent work of the United States Forest Service that have developed so rapidly as to be hard to follow from a distance. Conference on professional subjects with Forest Service men and with several of the other State Foresters whom I met in Washington or elsewhere in the East, was not only an agreeable experience, but gave me much to bring back to my work here that is of direct benefit to the forest work of the Territory.

Incidentally it may be of interest to note a fact perhaps not generally known, that Hawaii is one of the eleven states in the Union to employ a professional forester.

Appointment of Conservation Commission.

On July 23, 1908, Governor Frear appointed as the "Territorial Conservation Commission of Hawaii," the following persons: Messrs. Ralph S. Hosmer, Chairman; W. O. Smith, Alonzo Gartley, Jared G. Smith and Walter F. Dillingham—the three first named being the Governor's "Advisors" at Washington.

In accordance with the instructions of the Governor, the Commission immediately took up an investigation of the natural resources of the Territory with a view to recommending plans for their wise development and rational use. A preliminary report, with recommendations, was prepared and submitted to Governor Frear just prior to his departure for Washintgon early in November. This report, which contains some statements of fact not before available, is given in full elsewhere in this volume. It was first published in the Pacific Commercial Advertiser of Honolulu, then in the December issue of the Hawaiian Forester and Agriculturist, and generally distributed.

The Commission is in close touch with the National Conservation Commission and stands ready to coöperate with the Conservation Commissions of other states and territories. From time to time as occasion may arise the Commission will bring to the attention of the Governor facts and figures of interest in connection with the use and conservation of natural resources, with recommendations in regard thereto.

The members of the Commission will be glad at any time to receive suggestions and communications pertinent to the subject in hand from any one interested.

Visit of Honorable F. H. Newell.

The event of greatest importance in Conservation matters in Hawaii during 1908 was unquestionably the visit to the islands in the autumn months of Honorable F. H. Newell, Director of the United States Reclamation Service. Following almost immediately Secretary Garfield's return to the mainland it shows that Hawaii's claims for recognition are not only being heard but responded to from Washington. Already Mr. Newell has been of signal assistance to the Territory in getting the plans for a hydrographic survey definitely under way. The coming year will see no small development along that line. All of which leads to making Hawaii a better place to live in and consequently to its development as a true American community.

At the invitation of the Governor the Superintendent of Forestry accompanied Governor Frear and Mr. Newell on a portion of their tour of the other islands, going with the party to Molokai and Kauai. On these trips it was possible to discuss with Mr. Newell a number of forest problems on the ground. Needless to say, many valuable suggestions was one result of these informal conferences.

BOTANICAL COLLECTION.

In October, 1908, Mr. Joseph F. Rock was engaged by the Division of Forestry as Botanical Assistant. Mr. Rock's duties

are to gather herbarium material and seeds of Hawaiian plants needed for exchange purposes. Particular attention is paid to the arborescent flora, including trees, shrubs and woody creepers, but it is hoped that eventually the Herbarium may include specimens of all the native and introduced plants.

During the months of November and December there were collected on the Island of Oahu 1,506 specimens. The number includes duplicates for exchange as well as original specimens for the Herbarium. Roughly classified there were of

Trees and shrubs	1,016
Cryptogams	280
Algae	210
	<hr/>
	1,506

The number of species of Phanerogams is 202; of Cryptogams 120; of Algae 146; a total of 468.

The best and rarest specimens of indigenous Hawaiian plants were collected in the Koolau Mountains between Kahana and Laie; especially on the main ridge of Punaluu and Kaliuwa.

Although the season was unpropitious for collecting seed some was obtained from plants of the following genera: *Pithosporum*, *Myrsine*, *Lobelia*, *Darboutia* and *Pritchardia*.

It may be in place here to mention that there has also been added to the Herbarium a collection of Algae, Hawaiian sea weeds, "Limu," collected by Mr. Rock previous to his connection with the Division of Forestry. Many of these are edible and consequently have some local economic importance. In order to display certain of these Limu and other botanical specimens having popular interest, a standard with swinging frames has been constructed and placed in the Exhibit Room in the Board building, in which specimens of sixty different plants, properly named and labelled, are shown in a way to attract attention and facilitate study.

A forest herbarium is the necessary foundation for any sytematic investigation of the native Hawaiian forest. Such a detailed study must in time follow. For to devise plans for the most efficient handling of the Hawaiian forest reserves requires an intimate knowledge of the habits and life histories of many species. The study of the relations between the various members of the complex plant family that together make up what we term a forest is one of the problems that awaits attention. The collection of an herbarium is a help toward its solution.

FUNGUS DISEASE ON MAUI.

During the year 1908 not as much progress as could be wished has been made toward the control of the trouble, presumably due to a fungus disease, that is causing serious damage to the forest on the windward slopes of Mt. Haleakala on Maui. Believing that the first step necessary was to find out the exact cause of the trouble, arrangements were made for a thorough examination of the forest by one of the staff of the Division of Vegetable Pathology of the Hawaiian Sugar Planters' Association Experiment Station. This investigation is now in progress. As yet there is nothing to report.

In the expectation of subsequent planting to reforest certain of the areas where the native Hawaiian forest has been killed, the Division of Forestry is now in correspondence with its exchanges in regard to securing trees and shrubs similar in ecological character to those of the original forest. Heretofore, most of the importations of forest trees into Hawaii have been made mainly with the idea of planting for commercial return. In the present instance watershed protection is the need. It is expected that some desirable plants can be secured in this way and that practical results will follow their planting.

ARBOR DAY.

The annual celebration of Arbor Day is now firmly fixed in Hawaii. This year the date set by proclamation of Governor Frear was Friday, November 13. As usual Arbor Day was primarily an occasion observed in the schools, but not a little tree planting was done by individuals as well.

Through the coöperation of the Department of Public Instruction the largest number of trees ever sent out for Arbor Day planting—5,777—was furnished free from the Government Nursery to 71 schools. The planting this year was along the roadsides approaching the schools, most of the school lots having been planted with a sufficient number of trees in earlier years.

In addition to the trees given out free to the schools, there were also distributed from the Government Nursery, freight prepaid to the other islands, free trees for homestead planting. Each homesteader who responded to a general offer was given fifty trees. The trees offered were Swamp Mahogany (*Eucalyptus robusta*), Silk Oak (*Grevillea robusta*) and Ironwood (*Casuarina equisetifolia*). Lots could be made up of a mixture, or be all of one kind, as the recipient preferred. In all 9,926 trees were sent out. This Arbor Day distribution of trees is distinct from the routine work of the Government Nursery, the details of which are outlined in the report of the Forest Nurseryman.

NUUANU AND TANTALUS FORESTS.

There is no startling news to report from either of these planted forests during the year, except that with the final decision of the Lanai suit the title to the Tantalus Forest definitely passes, without question, to the Territory. This will permit the undertaking during the early part of 1909 of much needed thinings, and the clearing out of dry underbrush that greatly increases the fire danger.

The one forest ranger so far appointed, David Kapihe, has continued during the year to patrol the Tantalus Heights District and to oversee the burning of brush under permits issued by the District Fire Warden.

RUBBER INVESTIGATIONS.

THE PRESENT STATUS OF RUBBER IN HAWAII.

The production of rubber has come during the year 1908 to take its place as one of the recognized industries in Hawaii. This desirable position has been reached through the successful completion of a series of systematic tapping tests which proved that rubber can be collected and prepared for market from the trees in the rubber plantations on the Island of Maui at a cost that insures profitable returns—the work being done by ordinary laborers under conditions that would obtain in actual commercial practice. This experimental tapping is part of a coöperative investigation now being conducted jointly by the Division of Forestry and the Hawaii Experiment Station.

THE TERMS OF THE EXPERIMENT.

It may be recalled that in 1906 during an investigation by this Division of the planted forest on Kauai there was brought to public attention the existence of two groves of Ceara rubber trees on that island. Arrangements were at once made to tap these trees, the work being undertaken by the Hawaii Experiment Station, as that Station then had a man available for the work and the Division of Forestry did not. The results of the tests made on Kauai, with other matters germane to the subject, were published during the spring of 1908 as Bulletin No. 16 of the Hawaii Experiment Station. That bulletin is an important contribution, but it does not answer all the questions involved, particularly the crucial one of whether rubber can be collected at a cost that justifies the industry as a commercial proposition. To meet this need the Division of Forestry proposed to the Hawaii Experiment Sta-

tion that a joint investigation be undertaken: the Experiment Station to provide the men to do the field and laboratory work, the Division of Forestry to pay the bills. Twelve hundred dollars has been allotted for this purpose. The Directors of the four rubber plantations at Nahiku, Maui, cordially endorsed the plan and have actively coöperated by giving the agent in charge the right to tap the requisite number of trees and by furnishing laborers to work under his direction.

From the start the experiment was planned with special reference to securing figures that should have direct practical bearing on the commercial development of the rubber industry. To attain this result there was kept constantly in mind in planning the tapping tests the conditions that the rubber plantation manager must face daily in actual practice. To this end it was arranged that there should first be tried only the simplest possible methods of tapping, such as any laborer of ordinary intelligence could learn to do, and that all refinements of process, at the start be done away with. It was further provided that any given tapping test should be made on a large enough number of trees to be really representative and that each such test should be continued as long as the size of the trees warranted. Another provision of the same order was that an accurate record be kept of the time of all laborers employed, in units of not less than one-half of an actual working day—the experiments being so planned as to keep the men busy during that time.

In working out the details of the experiment the plan broadened somewhat in scope so that finally it fell under four main heads, as follows:

First. Experimental tapplings to determine the cost of collecting latex under conditions of commercial practice.

Second. Comparative tests of different methods of tapping to ascertain which one is best adapted to the local conditions, in view of cost, time required, effect on the flow of latex, and general influence on the tree.

Third. A study of the methods of handling the latex after it has been collected, with special reference to control by chemicals or by other means, so that as large a percentage as possible may be sold as high grade rubber. The best way of handling the "scrapings" is an important phase of this problem.

Fourth. A study of methods of cultivation and fertilization, to find out how through these means rubber trees may be brought sooner to the point of tapping, or by increased vitality be made to yield larger quantities of latex at an earlier age or for a longer period of flow.

Along with the main points enumerated much information will also be got on such related matters as the best spacing of the trees, the appropriate season of the year for planting, intercultural

crops, and the like. The work under the third head, methods of chemical control, will be performed at the laboratory of the Hawaii Experiment Station in Honolulu as it is of a character requiring special equipment and knowledge only possessed by a trained chemist. There are enough rubber trees on the station grounds and in the Tantalus forest to provide the necessary latex. All the rest of the work will be done in the field on the several rubber plantations at Nahiku, Maui. The experiments were started early in October; they will be continued during the remainder of this fiscal period.

The two important points on which the success of the rubber industry in Hawaii turns are first, whether the trees yield latex in commercial quantities, and second, whether the latex can be collected and prepared for market at a profit. Even in its initial findings this experiment has gone a long way toward answering these questions.

RESULTS OF THE TAPPING TESTS.

At the second annual meeting of the Hawaiian Rubber Growers' Association held at Honolulu on November 20, 1908, Dr. E. V. Wilcox, Director of the Hawaii Experiment Station, told of the results of the experiment so far as they had then been obtained. After the meeting he prepared a written statement, embodying the essential facts. This statement, reprinted from the Hawaiian Forester and Agriculturist for December, 1908—which number contains a full account of the Rubber Growers' meeting—is as follows:

Results of Experiments in Tapping Ceara Rubber Trees.

[Statement by Dr. E. V. Wilcox at the Hawaiian Rubber Growers' Association Second Annual Meeting.]

"The rubber experiments which are being carried on by the United States Experiment Station and the Territorial Board of Agriculture and Forestry have been under way long enough to indicate certain results which are of practical importance to rubber growers. Thus far more than 200 trees, most of them less than three years old, have been tapped. These trees averaged from twelve to thirteen inches in circumference and were located chiefly on the grounds of the Koolau Rubber Company, on Maui. In tapping young trees it was not expected that profitable returns of rubber would be obtained; but the plan involved the practical point of determining the rapidity with which trees could be tapped, and satisfactory methods of handling labor to the best advantage.

In the first series of 80 trees, which were tapped by means of one vertical cut each day, it required thirty-six hours and forty minutes of labor to tap the trees, collect the latex, and secure $1\frac{1}{2}$ pounds of dry rubber. In the second series of experiments on 160 trees, which were tapped with two vertical cuts instead of one, it required only forty hours of labor to tap the trees, collect the latex and obtain five pounds of first class rubber and about a pound of scrap rubber. In this experiment in which two vertical cuts were used daily, profitable returns were obtained.

"It was found that an ordinary laborer could tap rubber trees, by means of two long, vertical cuts, at the rate of about 50 trees an hour, and could collect latex at the rate of 100 trees an hour. The available labor on plantations appears to be reasonably effective in doing this work, and the amount of training required in order to make the cuts effectively and quickly is not excessive.

"It requires less time to tap older trees than the young trees, upon which our work is done, and there is also less danger of injuring the trees. We have found that a good flow of latex can be obtained from tapping done from daylight until 8 a. m., or even later.

"From the experiments which we have thus far conducted it appears that one man can tap about fifty trees per hour, while another man can collect the latex from the trees which would be tapped in the same time by two men. Since it appears from results which we have obtained from tapping mature Ceara rubber trees, that about one-third ounce of dry rubber may be expected as a daily yield, it is evident that three men should be able to obtain rubber from mature trees at the rate of about one pound per hour. The data upon which this conclusion is based have been carefully considered and the estimate is probably not above what may be expected. At any rate, the results obtained in our experiments indicate clearly that the Ceara rubber tree in Hawaii will not only grow and thrive, but will yield profitable returns.

"Further experiments will be carried on in the microscopic examination of sections of the Ceara rubber tree to get a basis for determining the best methods of tapping. Several other species of rubber trees will also be tapped and an elaborate series of fertilizer experiments with rubber is planned. We hope to be able to devise a method of fertilizing rubber trees so as to secure an increased flow of latex during the tapping periods."

MR. WATERHOUSE'S REPORT ON RUBBER.

In October, 1907, Mr. F. T. P. Waterhouse of Honolulu was appointed a Special Agent of the Board of Agriculture and Forestry to investigate the rubber industry in the Malay Peninsula

and Ceylon. On his return from the Orient Mr. Waterhouse prepared an interesting report of his findings, which was printed jointly by this Board and by the Hawaiian Rubber Growers' Association. The report appears in full in another part of this volume.

THE DISTRICT FORESTERS.

During the past year only one change has taken place in the personnel of the volunteer staff of District Foresters and District Fire Wardens, the resignation, on account of removal from the Territory, of Mr. C. B. Wells of Wailuku, Maui. He is succeeded by Mr. H. B. Penhallow, also Mr. Wells' successor as Manager of the Wailuku Sugar Company.

The boundary line between the districts of Messrs. Munro and Conradt on the Island of Molokai has been altered to effect a better division of the island and to facilitate supervision. Mr. Munro now has all of the island lying to the west of Wailau Valley and the land of Mapulehu. Mr. Conradt's district includes these lands and all to the east of them.

Revised lists of the District Foresters and District Fire Wardens are given on another page of this report.

REPORTS OF DISTRICT FORESTERS.

Following the usual custom opportunity was given each of the District Foresters to record briefly notes of forest happenings in his district during the year or other matters worthy of record. The following abstracts are from the answers received:

Mr. A. F. Knudsen—Waimea, Kauai.

"In reference to the planting of *Acacia melanoxylon* at Halemanu in the Waimea (West) Forest Reserve, I would like to report that from the same sowing of seed in 1906, several young plants came up in the month of December, 1908, and were observed by me in January, 1909.

"These seeds were scattered broadcast and quite a number came up after the first rains. The spot was marked with a stake and by the first comers, now about 5 feet high. In that same plot this year about 25 more have come up and seem to thrive. It is impossible that these come from any other seed than those sown in 1906."

Mr. Francis Gay—Makaweli, Kauai.

"As Forester for the Waimea section of Kauai, I beg to report to you that our forests are in better condition than they have

been for some years past owing to the killing off of wild cattle, and the young trees are coming up everywhere and notwithstanding the very dry season we have had our forest is in fine condition.

"The only tree I find that is at all touched with blight, is the Aiea, but the blight on it seems to be going off, and I hope will soon disappear entirely.

"Our lower lands are already covered with Algaroba where cane is not grown so we have done very little tree planting in this section this year.

"I find that the rubber plants you gave me which I planted upon the government section, have hardly grown any, and I believe that the land is too dry for rubber.

"There have been no fires in our forest reserves this year, but several on our pasture lands owing to the very dry state of the grass, but all have been promptly extinguished.

"We still keep in force our old fire law, which works well; that is that all who assist in extinguishing any fire get \$1.00, which is paid by the person who starts the fire, so that all who see a fire hasten to it and there is generally no trouble in extinguishing it before it goes too far."

Mr. John Herd—Koolaupoko, Oahu.

"In compliance with your request I herewith submit a report on forestry conditions in this section for the calendar year 1908. The only matters of special interest to report in this connection are the continued plantings on the Maunawili Ranch, as well as the starting of a coconut plantation on a section of Kailua near the sea. All these plantings may, however, be regarded to a very great extent as agricultural propositions, particularly as the large majority of trees planted in the Maunawili section have been rubber of varied varieties, and those at Kailua, coconuts for future agricultural purposes. The total number of all kinds of trees other than rubber planted at Maunawili Ranch during the calendar year amounted to 4,536, covering in all about 60 acres distributed as shelter and windbreaks, as well as for ornamental purposes.

"I would again call your attention to the decay in the native forest trees in this section, particularly "*Acacia koa*," which continues to suffer from the attacks of Lepidopterous larvae, which destroys all seeds as well as the young twigs. Avocado Pear trees have practically all been destroyed in this district by a fungus disease, as well as attacks by species of borers, for some years past. The fruit of the Mango tree continues also to be attacked by a species of fungus, few of these coming to maturity. Ohia (mountain apple) trees continue producing much dead growth from the top of the trees, which, as previously reported, is also supposed to be the result of fungus attack.

"It is quite important that these various fungi and other troubles be properly investigated by scientific men who are competent to undertake such systematic as well as economic work. Nothing of any moment has been done in this direction, and unless improvement as to present conditions occurs in the near future, it will be practically useless to make further plantings of very many varieties of trees which have heretofore been quite suitable to this section of country from an economic standpoint."

Mr. H. B. Penhallow—Wailuku, Maui.

Forestry: Of particular note is the establishing of a forest nursery early in the year by the Wailuku Sugar Company. It is the intention of the plantation to set out with suitable trees certain lands at Waihee and Waikapu which cannot be planted to cane, and the lands immediately above the cane fields. The chief object is to establish a source of supply for fire wood, fence posts and railroad ties. In addition to the above, the camps are being provided with shade and fruit trees, and certain localities with wind breaks.

"Owing to the lack of rain no planting was done until October, but by the close of the year over four thousand trees were set out.

Forest Trees: Excepting a small grass fire in the mountains above Waihee on February 19th, 1908, started by a demented Hawaiian, we were free from any fires, that threatened the forests, notwithstanding the particularly dry weather experienced throughout the year."

Mr. L. von Tempsky—Makawao, Maui.

"I have planted this last year some 19,665 trees. Owing to the unprecedented drought which we passed through (which entailed watering some ten thousand trees) the expense was greater than in former years, and also, I have been trying the planting of trees in cultivated land, as against the ordinary furrow and kipikua method, which of course entails a larger outlay at first, but which I think from the quicker growth obtained will in the long run prove the cheaper plan of the two.

"In September, 1907, I measured off a rectangular piece of land containing exactly four acres. One acre I furrowed out, and "kipikuaed" holes six feet each way. The other three acres I plowed and harrowed twice, and as the Manienie sod was very heavy I had to hand work the whole piece, going over it with 'kipikuas' and packing out what wouldn't burn. As the weather was quite wet I could not get a fire on the grass prior to plowing; this of course made the preparation of the three acres very ex-

pensive. I selected this spot especially as I thought it would be a good place to determine the maximum cost of preparing land for planting trees in this style.

"The seedling trees I selected were, *Eucalyptus amygdalina*, *E. botryoides*, *E. corymbosa*, *E. corynocalyx*, *E. leucoxylon*, *E. paniculata* and *E. rudis*, which were recommended to me by the Australian Forestry Service as being considered by them to be among the best of their trees for railroad ties and fence posts.

"The cost of the two pieces is as follows:

One Acre Lot.

Furrowing	\$ 2.60
Holeing	3.60
Planting	2.60
Weeding to date (twice)	9.60
	<hr/>
	\$ 18.40

Three Acre Lot.

Plowing	\$ 16.09
Harrowing	3.15
Kipikua work and twice weeding	102.70
Holeing	17.44
Planting	7.52
	<hr/>
	\$146.90

Or \$48.97 per acre.

"The holeing of the three-acre piece cost more than it should have done, as owing to running out of seedling trees, planting of about half this lot had to be postponed, and the holes dug over again.

"To offset to a certain extent the cost of the three-acre lot, I thought it would be as well to try some quick growing crop that would not take up too much room, and would to as small an extent as possible retard the growth of the trees. I selected California potatoes, and treated the seed to a bath of sulphate of copper, to see if that would prevent the rot that is so prevalent in Kula.

"Last July notwithstanding the rot that did attack them, and the exceptionally dry weather that we have had all this year, I took off a crop of potatoes that netted me \$69.19. This amount deducted from the cost, \$146.90, left \$77.71, or say \$25.90 per acre, for the three acre apiece, as against \$18.40 for the uncultivated acre.

"One year from planting the trees the following measurements were made:

"The tallest tree in the uncultivated lot was 5 feet 3 inches, a *Eucalyptus botryoides*, and the average height of the whole of that piece was 3 feet.

"In the cultivated lot the tallest tree measured 16 feet, *E. rudis*, the other tall ones being: *E. botryoides*, 15 feet; *E. corynocalyx*, 12 feet; *E. leucoxylon*, 12 feet; *E. paniculata*, 12 feet; *E. corymbosa*, 6 feet.

"The best average height, and the evenest grown lot of trees was the *E. botryoides*; the poorest being the *E. corymbosa*. The average height of the whole three-acre lot was over 10 feet. One stray Blue Gum, *E. globulus*, that was accidentally planted in the cultivated lot measured 12 feet in height. This tree had exactly the same treatment the others had, which goes to show pretty well, that both *rudis* and *botryoides* are faster growers than the *globulus*; both these species are ranked very highly in Australia for railroad ties and fence posts. This is well to be known, especially as the *E. globulus*, or Blue Gum, is the Eucalyptus most commonly grown at the islands, and except for firewood, is the poorest for any purpose.

"Considering the unusually dry weather we have had for the last twelve months, I consider the growth of the trees in the cultivated lot remarkable.

"Under normal conditions, that is, where there is not a heavy growth of Manienie to contend with, the cultivation of the trees should cost very much less than the amount above shown.

"The difference in favor of the cultivated as against the uncultivated trees is so great in favor of the former, that I shall favor the cultivation of all trees hereafter planted on the ranch, wherever the location is such as to make it possible.

"As showing what the possibilities are of fence post production, I would call attention to figures heretofore reported, viz: That last year I cut 244 good fence posts, five to twelve inches in diameter, from 38 second growth *Eucalyptus rostrata* trees, twelve years old. Some of these posts have been put in the ground plain and the balance subjected to creosote treatment by the Kahului Railroad Company. All of these posts will have the date stamped on them, and the place of use recorded in the Ranch Forestry book, so that their respective life in the ground can be ascertained accurately.

"I have adopted a method of planting this year that will in time to come prove very useful as a means of identifying the various species of Eucalypti that I am now growing for railroad ties, fence posts, etc., etc.; that is, planting them in alphabetical order according to their names, from mauka, makai. And as the lots

in which they are planted are numbered, and the varieties recorded in the Ranch Forestry book, my successor in future years will have something tangible to work on.

"For instance, Lot No. 7, Kula Homestead Road, has planted in its upper or mauka lines the *Eucalyptus amygdalina*, next to it comes *Eucalyptus botryoides*, then *E. Crebra*, *E. gunnii*, *E. paniculata*, *E. polyanthema*, *E. rostrata*, *E. rudis* and *E. siderophloia*, which occupies the lower, or makai, lines in the lot.

"These varieties are what I am confining myself principally to planting, as they are all of known value in Australia for railroad ties, fence posts, etc., etc., and they are nearly all rapid growers, more especially so the *E. botryoides* and *E. rudis*.

"The latter part of 1908 I planted another cultivated lot of four acres of *Eucalyptus*; in this lot, between the tree rows, I propose to plant soya beans, with the object of reducing the expense incurred and cultivation; results will be reported later on.

"The *E. siberiana* that I planted at an elevation of 6,000 feet promise well, and from what I can learn of this variety, should be well suited to the higher altitudes of the islands.

"I have also planted an avenue of *Cryptomeria japonica* (along the road mauka of the ranch house, about three-quarters of a mile in length) which promises to make a fine showing in a few years time.

"The pines, outside of *Pinus canariensis*, have been very disappointing; there must be something connected with their cultivation that I have yet to learn, as I have no luck with them at all. I am now trying planting them in the ground in the nursery out of the boxes, where I propose to keep them till they are two years old before moving to their permanent resting place."

*Trees Planted by the Haleakala Ranch Company During the
Year 1908.*

<i>Eucalyptus amygdalina</i>	}	17,305	Planted at from 2,500 to 3,000 feet elevation
“ <i>botryoides</i>			
“ <i>crebra</i>			
“ <i>gunnii</i>			
“ <i>paniculata</i>			
“ <i>polyanthema</i>			
“ <i>rostrata</i>			
“ <i>rudis</i>	}	550	Planted at 6,000 feet elevation.
“ <i>siderophloia</i>			
“ <i>siberiana</i>			
<i>Sequoia gigantea</i>		10	Planted at 2,500 feet elevation.
“ <i>sempervirens</i>		100	Planted at 2,500 feet elevation.
<i>Cryptomeria japonica</i>		900	Planted at 2,000 feet elevation.
<i>Pinus ponderosa</i>	}	800	
“ <i>jeffryi</i>			
“ <i>canariensis</i>			
“ <i>insignis</i>			
“ <i>coulteri</i>			
		<hr/> 19,665	

MAUI AGRICULTURAL COMPANY'S TREE PLANTING.

In connection with the planting on Maui special mention may well be made of the active interest in tree planting shown by Messrs. David T. Fleming and William Hannestad, the two men on the staff of the Maui Agricultural Company charged with the duty of growing and planting trees. Mr. Fleming has the section in and about Haiku; Mr. Hannestad the lands at a higher elevation from Kailiili to Opana.

At Kailiili Mr. Hannestad has been able to use successfully methods in the nursery and in planting out the trees, which though common in the temperate zone have been shown by experience to be impracticable in lower and drier sections in this Territory. It is a matter of no small importance to know where seed beds can be used to advantage and forest planting done with transplants, for by these methods the cost of planting can in many cases be materially lessened.

Mr. George C. Watt—Kohala, Hawaii.

"In reply to yours asking me for a report on the conditions of forestry work in the Kohala District, I would say that nothing of interest has taken place during the past year. The Kohala Sugar Company still continues planting trees in waste places. Last year we planted for wind breaks about eighteen acres of gulch sides.

"I enclose a letter to me from Mr. P. W. P. Bluett, Superintendent of the Kohala Ditch Company, which I asked him to write describing the condition of the Kohala Forest, he having spent the greater part of the last three or four years in the Kohala Mountains and is eminently fitted to give a description of the forest in the Kohala Mountains.

"I think it highly desirable that these Kohala Forests should be made a Government Reservation and that with the least possible delay."

Mr. Bluett's Report on the Kohala Forest.

Kohala, Hawaii, January 14, 1909.

"G. C. Watt, Esq.,
Kohala.

"Dear Sir:

"In writing you, at your request, a letter describing the condition of the Kohala forest as I have most recently observed it, I will endeavor to put the matter in as concise a form as possible. Let me premise by saying that, during the past year, I have, in the interests of the Kohala Ditch Company, investigated the sources of all the streams supplying the Ditch, traversing, during this period, the entire watershed from Waimanu to Puu Pili.

"One of the first features to attract attention in the upper elevations is the absence of living timber of large size and the presence of very numerous skeletons of what were once giant trees. On the other hand, trees of smaller growth, principally Ohia, are plentiful and vigorous and, in places which have not yet been penetrated by cattle, young and healthy shoots are numerous. In considering the effect of the forest on the watershed I was greatly impressed by the importance of the part played by the heavy underbrush, extending as it does, almost over the entire area. Pulu ferns of great size combined with smaller varieties and matted masses of vines, form an ideal break to the great quantities of water which, during heavy rains rush down the slopes of the Kohala Mountains, disseminating this water over the flats of large area which are so frequently to be met with, and which, by the absorption, at frequent intervals, of large quan-

tities of water become the swamps in which all the streams and springs forming the water supply of North Kohala have their source.

"The preservation of this underbrush appears to me to be of equal importance with the maintenance of the trees, but, in certain sections of the forest the destruction of both is going on simultaneously, and more particularly on the Kohala side where it is apparent that the western boundary of the forest is receding rapidly. Places, which, a few years back, were deep swamps, covered and surrounded with dense vegetation, are now open country, over any portion of which a heavily laden wagon may be driven. The causes producing these destructive effects are, according to my personal observation as follows: (1) Cattle, (2) pigs, (3) insect pests. Both wild cattle and pigs are present in the western portion of the forest in large numbers, the latter being so prolific that it is not uncommon to run across several litters in one day.

"Both classes of animal are destructive in the same way, i. e., by the consumption of the underbrush and the roots and bark of young trees for food and by the tramping down of vegetation and the bruising and exposure of the roots of trees. In many places the trails of these animals form a perfect network and afford channels for the passage of water and consequent erosion of the soil at the base of the trees. In regard to the third cause, I am unable, through lack of knowledge of the subject, to say what particular variety of insect is responsible for the damage, but the effect is rendered obvious by an examination of the dead trees, some of which are absolutely honeycombed with holes. The section of the forest which, at present appears to be in the best state of preservation is that portion between Honokane Nui and Waimanu, where it is, in all respects, denser and more vigorous.

"In this section, at the lower elevations (2,000 to 3,000 feet) the Loulu palm is comparatively plentiful, but many fine specimens have been cut down in the past by persons wishing to obtain the young leaves for straw making purposes. Still lower I have found a few solitary specimens of the sandal wood tree, of the true variety, but all in a state of complete or partial decay, caused by some boring worm which also attacks and destroys the seed on the ground.

"At the eastern extremity of the Kohala Mountain range and at an elevation of approximately 5,000 feet there is quite an extensive patch of Mokihana which, heretofore, was not supposed to exist in this region, and which, I am informed, is supposed to grow only on Kauai.

"In conclusion I would say that, should you or any one interested in the preservation of the forest, wish to make a visit of

investigation to that section of the country I shall be most happy to have you accompany me on one of my frequent trips.

Yours very truly,

P. W. P. BLUEETT,
Superintendent, Kohala Ditch."

Mr. John Watt—Puna, Hawaii.

"Forest conditions have not changed materially since my last report. There are one or two items which may be of interest to your Board which I will mention at this time.

"The Hawaiian Mahogany Lumber Company have logged about 400 acres of forest adjoining the cane fields of Pahoa; also from 50 to 100 acres of forest land at Kaohe Homestead. This land will be all available for agricultural purposes, and will, undoubtedly, be planted to sugar cane in the near future.

"The Pacific Development Company have planted a considerable area of land cleared of forest to rubber trees in the Puna District, between Pahoa and Kapoho. I understand these trees are growing remarkably well.

"*Fires:* There have been no forest fires during the past twelve months. A great number of fires have been started from time to time on the Pahoe-hoe lying between the Olaa Sugar Company's fields and the cane fields of the Puna Sugar Company. As the forest on this country is very sparse and the trees small, little or no damage has been done in this respect; but these fires are a great menace to landowners cultivating cane adjoining the Pahoe-hoe."

Mr. R. von S. Domkowicz—South Kona, Hawaii.

"I may mention that I made some trials of raising various kinds of pine trees from seed such as your Department furnished us, but it has not been a success. But such trees as *Cryptomeria japonica* and various Cypresses are doing very well; climate and soil seems to be especially adapted to them."

Mr. John Maguire—North Kona, Hawaii.

"There has been very little forestry work in my district during 1908.

"The planting of trees is a matter of chance in this district. If the weather is good and we have a rainy year, then the young trees will get a good start.

"Mr. Frank Greenwell has planted on his place at Honokohau between 70 and 80 rubber trees from a few months to a year old

and averaging from 2 feet to about 5 feet. This has been an exceptionally dry year, so that the trees have not had a fair start. Honokohau is in what we consider the rainy belt, the average rainfall there being about the greatest in the North Kona District.

"At Puuwaawaa, over 500 seedlings of all kinds of trees have been ready for planting out, awaiting good rains, but they have gradually diminished, owing to the scarcity of water, and some having grown through their containers were planted out and consequently died.

"The rainfall for the year 1908 at Puuwaawaa was 8.20 inches. The greatest fall in March, 3.08 inches, and the least in December, nothing at all. In January, 1908, there was .08 and in June .04.

"I notice in the record of rainfall kept here at Huehue the last eight years, and the amount decreases farther north on the slopes of Hualalai, that every other year there is a small record. The record of rainfall at Huehue, an elevation of 2,050 feet, has been as follows:

In 1901	51.76 inches
In 1902	43.13 "
In 1903	29.11 "
In 1904	59.84 "
In 1905	22.44 "
In 1906	44.38 "
In 1907	37.17 "
In 1908	19.18 "

"The section of Honuaula under reservation is doing well—the undergrowth already making a good showing."

FOREST FIRE SERVICE.

Notwithstanding the fact that the year 1908 has witnessed severe droughts in many districts of the Territory, the record in regard to forest fires is a most satisfactory one. Practically no damage has been sustained through forest fire, for in every case where a fire has started it has been quickly checked and extinguished. Just how much this is due to the forest fire law and to the better public sentiment in regard to forest fire that has been aroused thereby is hard to say, but probably not a little of the immunity from damage from fire is due directly or indirectly to the efforts that have been exerted under that law.

There is, however, one very pressing need in regard to forest fire that temporary immunity from injury should not be allowed to obscure. As it is now there is no money available from which men can be paid for fighting forest fires on unleased government land. Under the law owners and lessees of land are liable if fire

escapes beyond their boundaries. This acts as an effective lever in causing active measures to be taken to have fires put out on the land they own or control. But it does not provide for fighting fire on unleased government land—that is, in the established forest reserves or on those unleased government forests that have not yet been included within reserve boundaries. There ought to be a special emergency fund of at least \$5,000,00, to be drawn on only in case of need, to provide for this exigency. So long as there is no appropriation the Chief Fire Warden is practically powerless to take effective measures to stop fires that may start at any moment and do untold damage. This is an urgent need and should not be passed unnoticed by the Legislature.

List of Forest Fires During 1908.

Date 1908	Locality	District	Island	Area burn- ed over	Character of fire	Origin
Feb 19	Waihee	Wailuku	Maui	.....	Grass	Escaped brush fire
June 29	Waipio	Ewa	Oahu	.....	Grass & brush	Escaped brush fire
Oct 28	Waialua Valley	.....	Molokai	500	Grass & brush	Escaped brush fire
Nov 19	Waianae-uka	Ewa	Oahu	100	Grass	Cigar stump
		Kona	Kauai	Several grass fires		
		Puna	Hawaii	Several grass fires		

Periods of special fire danger have been proclaimed as follows: Tantalus Heights District, Oahu, twelve months from February 13, 1908—number of permits to burn brush issued, 21; Western end of the Island of Molokai, three months from September 28, 1908; Eastern end of the Island of Molokai, three months from November 3, 1908.

SUMMARY OF RECOMMENDATIONS.

The carrying out in a truly efficient manner of a program through which the forests of Hawaii can be made of greatest service to the people of the Territory requires an initial outlay in the way of appropriations for certain specific purposes.

The forests of Hawaii make possible the assured supply of water, without which the economic prosperity of the Territory would come to a stand still. Water from the forest reserves is now used chiefly in connection with the main industry of the Territory, the production of sugar cane. But as has repeatedly been pointed out, for the continued success of agriculture in Hawaii, whatever the crop, there must be water. This point of view has been especially emphasized during the past year by the authoritative statements made by Honorable F. H. Newell, Director of the United States Reclamation Service, during his trip to the Islands in the autumn months. An impartial opinion from such an authority is conclusive.

It is obvious that water is of crucial importance in the development of the Territory. Without the forests a continued supply cannot be maintained. Hawaii cannot afford not to make the forests do their full duty. And this can only be accomplished by providing the necessary men and means to bring the forests to the state of highest efficiency and to keep them there. Money invested in bringing the Hawaiian forests to their highest state of usefulness is as surely invested as if it went to buy high class bonds.

Succinctly the needs for which appropriations are asked are these: A forest ranger organization, a fund for fencing forest reserve boundaries on government lands, a special fund (to be used only in case of emergency) for fighting forest fire on government land, and provision for a technically trained assistant in the Division of Forestry.

It is further recommended that the law requiring that hunters pay a license fee (Act 116, Session Laws of 1907) be so amended as to allow the shooting of wild goats without a license, it being provided that permits be first obtained from local officials.

With provision made for its regular work and for these additional needs, the Division of Forestry will be in a position to render to the people of the Territory more efficient service than ever before. Money expended in bringing the forests to the point where they will do their full duty will surely be returned many fold in the increase in the prosperity of the Territory that is bound to follow a rational use of the natural resources.

Hawaii now holds, as for many years past, a prominent place in the sisterhood of States recognizing the importance of forestry and providing for forest work. It is not too much to hope that with the better understanding of the problems of Conservation that has characterized the past year, Hawaii will take an even higher place in that honorable company.

Very respectfully,

RALPH S. HOSMER,
Superintendent of Forestry and
Chief Fire Warden.

Report of the Forest Nurseryman.

Honolulu, Hawaii, December 31, 1908.

R. S. Hosmer, Esq.,
Superintendent of Forestry,
Honolulu, Hawaii.

Dear Sir:

I herewith submit a report of the work done at the Government Nursery, the Experiment Station, Makiki, the Nuuanu Station and the Tantalus Forest, including the giving of advice and assistance, for the year ending December 31, 1908.

NURSERY.

The collecting and exchange of seed have been continued and extra samples packages in addition to the list sent out a year ago, sent to those on our seed exchange list who asked for the same. Botanic gardens to the number of 17 have sent seeds and 10 have sent lists to select from. Altogether 248 packages of seed have been received through our exchange system. Many plants new to the Territory are being propagated at the Nursery and when large enough will be sent to the Experiment Garden in Makiki Valley.

VALUABLE INTRODUCTIONS.

Through the kindness of the Honorable A. de Souza Canavarro, Consul General for Portugal, who is much interested in economic plants, several consignments of seed of a grass known as *Esparta* (*Stipa tenacissima*) were handed to us to be propagated. We have successfully propagated about fifty plants from the seed received. Division of the root is said to be the safest way to propagate this plant, the growing of it from seed being considered difficult. The merits of this grass are well known, it being in great demand for paper making, also for ropes, baskets, mats, hats and other articles. The plants are doing well and they will be planted at the new Experiment Garden where they will be increased by root divisions, and in time distributed.

Another introduction which is worthy of note is the Mocha Coffee brought from Mexico by Mr. George R. Ewart, who handed the seed to us to be propagated. This coffee is said to be superior to any on the market and commands the highest price. Over

1000 plants were successfully raised from the seed and were distributed to people on the different islands of the group. Mr. Ewart drew up a list of people to whom he wished the plants sent, the Division of Forestry receiving a share. The plants given to the Division of Forestry will be planted and cared for at the new Experiment Garden.

The two new varieties of *Manihot* rubber trees, namely *Manihot dichotoma* and *Manihot piauhyensis*, the first to reach this Territory and of which mention was made in our last report, are doing well. A few plants of each kind were given to the Nahiku Rubber Company and the Hawaiian American Rubber Company in November, 1907. A few more trees of each kind were given to the two plantations mentioned in November of 1908. A small number of plants of each variety are still on hand and will be planted in the new Experiment Station, Makiki.

A number of other rare plants have been raised from seed and will be given a fair trial in the new Garden.

ARBOR DAY.

The number of trees ordered for the different schools of the Territory, to be planted on Arbor Day, November 13, was larger than it has been since Arbor Day was first proclaimed. Applications for trees were received from the principals of 24 schools on Hawaii, 10 on Kauai, 15 on Maui, 16 on Oahu, 5 on Molokai and 1 on Lanai; the total number of schools supplied with trees being 71, and the total number of plants sent out 5,777.

The offer to supply each of the homesteaders in the Territory free of charge, with fifty trees for Arbor Day planting was taken advantage of by a large number of homesteaders and altogether 9,926 trees were ordered by them. Owing to the great demand for trees for Arbor Day planting it was found to be impossible to supply all the homesteaders with trees in time for Arbor Day, but each received the amount ordered as time permitted.

PLANT DISTRIBUTION.

The following is the number of plants given away, sold and sent out for Arbor Day, also gratis to homesteaders, schools, improvement clubs, parks and others:

	Forest.	Fruit.	Orna- mental.	Total.
Arbor Day, Schools.....	3,700	..	2,077	5,777
“ “ Homesteaders ..	9,926	..	....	9,926
Gratis	1,150	50	960	2,160
Sold	13,052	32	3,552	16,636
	<hr/> 27,828	<hr/> 82	<hr/> 6,589	<hr/> 34,499

In addition to the above 20,000 seedling Ironwoods in seed boxes were sold to Paaulau Plantation Company; also 1,000 seed of Para Rubber (*Hevea brasiliensis*) and 1,000 seed of Central American Rubber (*Castilla lactiflua*) were propagated for the Puna Sugar Company.

The demand for forest trees has been larger during the past year than at any time in the past. All the plants sent out were first started in the two small propagating houses. The saving of seed owing to the protection given by these houses from ants, heavy rains, etc., has, I am sure, already saved more in seed and labor than the houses cost.

Considerable work has been done on the Nursery grounds. About 3,000 yards of soil were carted on to the grounds during the past two years to fill up the low-lying parts. Almost the whole of the ground has been graded and replanted in grass. Throughout the year we have had the use of two prisoners, kindly allowed us by Sheriff Henry, the use of which has helped us a great deal. I would therefore take this opportunity of thanking Sheriff Henry for his kindness in granting us the two men and for the interest he has taken in the work.

REALIZATIONS.

During the year there has been collected and deposited with the Treasurer of the Territory, as a Government realization, the sum of \$354.12. The amount is itemized as follows:

Sale of plants	\$291.87
Sale of seed	35.70
Sale of wood from Tantalus	10.00
Sale of Nursery material (paper pots).....	1.60
Receipts for fumigating plants.....	14.95
	<hr/>
	\$354.12

CONGRESSIONAL VEGETABLE SEED.

A consignment of vegetable seed, consisting of over 6,000 packages, was received during the month of January from the Honorable J. K. Kalaniana'ole, and distributed to people all over the Territory, including all the public and private schools. A large number of homesteaders and others applied for seed by letter and quite a number called at this office in response to a free advertisement in the local newspapers. The interest in the growing of vegetables seems to be increasing and the demand for seed is greater every year. The quality of the seed is praised very highly by those who have used it and they are eager to get their share when the new consignment arrives.

ADVICE AND ASSISTANCE.*Awini Tract: Kohala, Hawaii.*

During the month of February the writer visited the District of Kohala at the request of the Agents of the Kohala Sugar Company for the purpose of examining and reporting on a tract of land belonging to the Company, and known as Awini Tract. A report with recommendations was accordingly drawn up and a copy of same given to the Agents.

Paumalu: Waialua, Oahu.

In accordance with an agreement between Mr. James W. Pratt, Commissioner of Public Lands, yourself and Mr. Frederick Lyman, owner of Lot 6, Paumalu Homesteads, the writer was requested to proceed to Paumalu for the purpose of making an examination and report on the condition of the Forest Reserve in that section and particularly in regard to thinning, and removing dead trees. A report with recommendations was accordingly drawn up, copies of which were sent to Mr. Pratt and Mr. Lyman, the original being placed on file in this office.

Lower Pauhala: Waikele, Oahu.

During the month of October at the request of Mr. Weinrich, Manager of the Hawaiian Fiber Company, a visit was made to the Company's lands at Lower Pauhala, for the purpose of giving advice on the cultivation of fruit and other trees to be planted on this land. Locations best suited to the different kinds of trees were selected and recommendations regarding the best methods of propagating seed and planting the trees were made.

Half-way House Property: Nuuanu Valley, Oahu.

On October 16th, at the request of Mr. H. Rahim, a visit was made to the Franca property lately acquired by Mr. Rahim. The visit was made for the purpose of giving advice on selecting and planting trees for windbreak purposes, also on the planting and care of fruit trees, etc.

Honolulu Plantation, Oahu.

During the month of December at the request of Mr. George Ross, Manager of the Honolulu Plantation, a tract of land running along the top of the cane lands and lying between the eleva-

tions of 500 feet and 700 feet above sea level was examined. The examination was made for the purpose of giving advice in regard to the planting of trees on this tract. The information desired was given and Mr. Ross intends starting tree planting on the land just as soon as the weather is suitable.

In addition to the above, fifty-five visits were made to places in and around the city. These visits were made at the request of people who desired information on subjects connected principally with the planting, cultivating and pruning of trees.

EXAMINING THE TREE PLANTING, ETC., ON KAUAI.

From the 6th to the 16th of August the writer paid a visit to the Island of Kauai. The object of the visit was for the purpose of examining the tree planting that has been done and is in progress, also getting more familiar with the conditions so that better results may be obtained by the selection of seed plants suitable to the different soils and locations. Many inquiries come to this office from all over the islands regarding the best trees to plant in the different districts and locations. The questions asked include the growing and care of forest trees, trees for windbreaks, road and street planting, also the uses of the trees in regard to lumber after they come to maturity.

On the Kauai trip the following places were visited: At Waimea the gardens of the Knudsen Brothers, Mr. Francis Gay and Mr. Aubrey Robinson. After leaving Waimea the tree planting done by Mr. Walter D. McBryde at Wahiawa was examined, also the water reserve known as "Papaholoholo Spring Reserve." The tree planting done by Mr. Walter McBryde deserves much credit and is indeed a very good object lesson of what can be done in this line. The tree planting done by the Koloa Plantation was examined, also the extensive work that has been done in tree planting at Lihue Plantation, both the beach, also the highland planting being examined. Grove Farm was also visited and the tree planting done by the Honorable George Wilcox inspected. On this trip a great deal of information was gained which will be of value, especially so when applications are made for plants or seed.

WAIANAE KAI FOREST RESERVE, OAHU.

On August 29th the writer paid a visit to Waianae for the purpose of examining the tree planting that is being done on the Waianae Kai Forest Reserve by the Waianae Company. Mr. F. Meyer, Manager, accompanied the writer and pointed out the work that he is doing in tree planting. Over 11,000 trees, prin-

cipally of *Eucalyptus* and *Acacia* varieties, have already been set out and are doing well. In the nursery which has been started in connection with the planting, a large number of trees are ready to be set out as soon as the weather is favorable.

NEW EXPERIMENT GARDEN, MAKIKI.

The new garden will fill a long felt want and will, there is little doubt, be of much value to the Division of Forestry and to the public in general. The large assortment of seed of new and rare plants which we are receiving through our exchange system, after being propagated at the Nursery will be cultivated and cared for in this garden. In time those species which prove to be of value for fruit, forest or ornamental purposes will be increased by seed or cuttings and given out to people who take an interest in such things and who guarantee to take good care of them.

Work was commenced on this garden on April 1, 1908, when two men were employed. The first work done was the making of a wagon road from the bend where the new branch of the Tantalus road connects with the Valley road. This so-called Valley road was in such bad shape, owing to the heavy rains carrying away the unpacked soil on top of the water pipe lately laid to carry the water from the dam at the top of the valley, that it was difficult and even dangerous for people to get over it on foot. Considerable work was put on the road with the result that we have managed to make a fairly good wagon road so that the plants raised at the Nursery can be transferred.

The piece of land upon which the garden is started contains about three acres. A wire fence has been built around three sides of the garden, the fourth or south side being bounded by steep rocks, which makes it proof against stray animals. A portion of the land has been trenched over to a depth of two feet. A few benches have been made to hold plants in pots, also a tool shed and another shed built for the men to work in on rainy days. A good water supply has been secured independent of the city supply. A small dam was built in the stream, which is kept fed by the rains at the top of the valley—also seepage from the water works dam. Only once during the long dry spell did the stream run dry. A one and a half inch pipe was laid along the center of the lot and three-quarter inch pipes connected with it. Over one-half of the garden is already connected with the water pipe. The soil is good and a beginning will be made soon to plant some of the valuable species we have on hand.

NUUANU FOREST.

The condition of the forest in the upper part of Nuuanu Valley is very good. The trees planted a number of years ago are doing exceedingly well and especially so on the part that was planted last. This part being farther from the Pali and not so much exposed to the heavy winds which sweep over the land near the Pali, is the reason for the much better growth of the trees. As far as possible the planted trees, as well as the indigenous trees are being kept clear of vines. The vine called "Maile pilau" is the worst, although the *Convolvulus* is detrimental to the growth of the trees in some parts and requires to be cut away. The work of clearing away the vines ought to be continued; also the guarding of the forest against trespass by mischievous people and stray animals. This work has been attended to during the period by the men employed, in addition to the work of clearing away vines, etc.

TANTALUS FOREST.

Although the lower part of the forest suffered considerably during the long dry spell—which is responsible for the dead trees to be seen near the lower edge of the forest—the health of the trees in general is good. Trails running through the forest have been kept clear by the Ranger. This is necessary and especially so during the dry season, as a protection against fires. No fires, however, have been reported in this forest during the year.

The forest is sadly in need of a careful thinning and clearing out of the dead or dying Lantana. The danger from fires is much greater since the Lantana started to die out than when it was green and healthy. Consequently a great deal of care ought to be taken by the people passing through the forest during the dry season. The throwing away of stumps of a cigar or cigarette might result in destroying thousands of dollars worth of property. Many of the trees in this forest are approaching maturity and will, there is no doubt, be valuable for various purposes.

Respectfully submitted,

DAVID HAUGHS,
Forest Nurseryman.

LIST OF DISTRICT FORESTERS.

(Corrected to December 31, 1908.)

Following is a list of the (thirty-nine) District Foresters with their respective jurisdictions. Those marked with a star (*) were appointed Special Territorial Police Officers to enforce the Terms of the Wild Bird Law, Act 104 of the Session Laws of 1907:

KAUAI.

* ALBERT S. WILCOX.

In and for the District of Halelea.

J. R. MYERS.

In and for the District of Koolau, excepting the land of Anahola.

* GEORGE H. FAIRCHILD.

In and for the land of Anahola and the northern portion of the District of Puna, extending as far as the land of Wailua.

* F. WEBER.

In and for the portion of the District of Puna, south of and including the land of Wailua, except the lands controlled by Grove Farm Plantation.

* EDWARD BROADBENT.

In and for those lands in the District of Puna, controlled by the Grove Farm Plantation.

REV. J. M. LYDGATE and * WALTER D. McBRYDE.

In and for that portion of the District of Kona, lying to the east of the Hanapepe Valley.

* FRANCIS GAY.

In and for that portion of the District of Kona, lying between and including the Waimea, Poomau and Kauaikanana Valleys on the west and the Hanapepe Valley on the east.

* AUGUSTUS F. KNUDSEN.

In and for the District of Na Fali and that portion of the District of Kona, formerly known as the District of Waimea, lying to the west of the Waimea, Poomau and Kauaikanana Valleys.

OAHU.

* ANDREW ADAMS.

In and for the District of Koolauloa.

* L. L. McCANDLESS.

In and for that portion of the District of Koolaupoko extending from Koolauloa to the land of Heeia.

* W. C. WEEDON.

In and for that portion of the District of Koolaupoko extending from and including the land of Heeia to the land of Kailua.

* JOHN HERD.

In and for that portion of the District of Koolaupoko extending from and including the land of Kailua to Makapuu Point.

* PAUL R. ISENBERG.

In and for that portion of the District of Kona extending from Makapuu Point to and including Manoa Valley.

* WALTER F. DILLINGHAM.

In and for the Districts of Ewa and Waianae.

W. W. GOODALE.

In and for the District of Waialua.

MOLOKAI.

* JAMES MUNRO.

In and for that portion of the Island of Molokai lying to the west of Wailau Valley and the land of Mapulehu.

* C. C. CONRADT.

In and for that portion of the Island of Molokai, including and lying to the east of Wailau Valley and the land of Mapulehu.

LANAI.

* CHARLES GAY.

In and for the Island of Lanai.

MAUI.

H. P. BALDWIN.

District Forester at Large for the Island of Maui.

* L. BARKHAUSEN.

In and for the District of Lahaina.

H. B. PENHALLOW.

In and for the District of Wailuku.

* H. A. BALDWIN.

In and for the District of Hamakuapoko and the western half of the District of Hamakualoa.

* W. F. POGUE.

In and for the District of Koolau and the eastern half of the District of Hamakualoa.

* C. J. AUSTIN.

In and for the District of Hana.

* L. VON TEMPSKY.

In and for the District of Makawao.

L. VON TEMPSKY and DR. J. H. RAYMOND.

In and for the Districts of Kula, Honuaula, and the lands beyond to and including Kaupo.

HAWAII.

* G. C. WATT.

In and for the District of North Kohala, and that portion of the District of Hamakua lying between the District of North Kohala and the Waimanu Valley.

* A. W. CARTER.

In and for the District of South Kohala.

* A. AHRENS.

In and for that portion of the District of Hamakua from and including the Waimanu Valley to the District of Hilo.

* JOHN M. ROSS.

In and for that portion of the District of Hilo extending from the District of Hamakua to the land of Makahanaloa.

* JOHN A. SCOTT.

In and for that portion of the District of Hilo extending from the District of Puna to and including the land of Kikala.

* JOHN WATT.

In and for the District of Puna.

* JULIAN MONSARRAT.

In and for that portion of the District of Kau extending from the District of Puna to and including the land Punaluu.

* GEORGE C. HEWITT.

In and for that portion of the District of Kau extending from the land of Punaluu to the District of Kona.

* R. VON S. DOMKOWITZ.

In and for that portion of the District of South Kona extending from the District of Kau to the land of Kaohe.

W. R. CASTLE.

In and for that portion of the District of South Kona extending from and including the land of Kaohe to the District of North Kona.

* JOHN D. PARIS.

In and for that portion of the District of North Kona extending from the District of South Kona to and including the land of Kahaluu.

* JOHN A. MAGUIRE.

In and for that portion of the District of North Kona extending from Kahaluu to the District of South Kohala.

LIST OF DISTRICT FIRE WARDENS.

(Corrected to December 31, 1908.)

Following is a list of (forty-nine) District Fire Wardens, with their respective Districts:

CHIEF FIRE WARDEN.

RALPH S. HOSMER.

Superintendent of Forestry, *ex officio*.

DEPUTY FIRE WARDEN AT LARGE.

DAVID HAUGHS.

In and for the Territory of Hawaii.

DISTRICT FIRE WARDENS.

KAUAI.

C. W. HUDSON.

In and for the Wainiha Valley, District of Halelea.

W. F. SANBORN.

In and for the District of Halelea, excepting the Wainiha Valley.

J. R. MYERS.

In and for the District of Koolau, excepting the land of Anahola.

GEORGE H. FAIRCHILD.

In and for the portion of the Districts of Koolau and Puna, extending from the land of Anahola to the land of Oloheua, inclusive.

F. WEBER.

In and for the portion of the District of Puna, south of and including the land of Wailua.

REV. J. M. LYDGATE.

In and for that portion of the District of Kona, formerly known as the District of Koloa.

FRANCIS GAY.

In and for that portion of the District of Kona, lying between and including the Waimea, Poomau and Kauaikanana Valleys on the west and the Hanapepe Valley on the east.

AUGUSTUS F. KNUDSEN.

In and for the District of Na Pali and that portion of the District of Kona, formerly known as the District of Waimea, lying to the west of the Waimea, Poomau and Kauaikanana Valleys.

OAHU.

ANDREW ADAMS.

In and for the District of Koolauloa.

FRANK PAHIA.

In and for that portion of the District of Koolaupoko, extending from the Koolauloa District line to the land of Heeia.

GEORGE CAMPBELL.

In and for that portion of the District of Koolaupoko, extending from and including the land of Heeia to the land of Kailua.

JOHN HERD.

In and for that portion of the District of Koolaupoko, extending from and including the land of Kailua to Makapuu Point.

CHARLES H. BAILEY.

In and for that portion of the District of Kona, extending from Makapuu Point to Palolo Valley.

H. J. RHODES.

In and for Palolo Valley, District of Kona.

W. M. GIFFARD.

In and for that portion of the District of Kona, lying between Pauoa and Manoa Valleys.

G. H. MOORE.

In and for Pauoa and Nuuanu Valleys, District of Kona.

WALTER F. DILLINGHAM.

In and for the District of Ewa and that portion of the District of Waianae lying to the East of the Waianae Mountains.

F. MEYER.

In and for that portion of the District of Waianae lying to the West of the Waianae Mountains.

* W. M. TEMPLETON.

In and for the District of Waialua.

MOLOKAI.

JAMES MUNRO.

In and for that portion of the Island of Molokai lying to the West of Wailau Valley and the land of Mapulehu.

C. C. CONRADT.

In and for that portion of the Island of Molokai including and lying to the East of Wailau Valley and the land of Mapulehu.

LANAI.

CHARLES GAY.

In and for the Island of Lanai.

MAUI.

H. P. BALDWIN.

Fire Warden at Large, for the Island of Maui.

LOUIS BARKHAUSEN.

In and for the District of Lahaina.

R. C. SEARLE.

In and for the District of Kaanapali.

H. B. PENHALLOW.

In and for the District of Wailuku.

H. A. BALDWIN.

In and for the District of Hamakuapoko and the west half of the District of Hamakualoa.

W. F. POGUE.

In and for the District of Koolau and the east half of the District of Hamakualoa.

JOHN CHALMERS.

In and for the District of Hana.

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In and for the District of Kipahulu.

J. H. RAYMOND, M. D.

In and for the Districts of Honuaula and Kahikinui.

L. VON TEMPSKY.

In and for the Districts of Kula and Kaupo.

HAWAII.

G. C. WATT.

In and for that portion of the north half of the District of Kohala, extending from the land of Kaaunuhu to the Hamakua District line.

SAM P. WOODS.

In and for that portion of North Kohala, extending from the northern boundary of the land of Kawaihae I to and including the land of Kaaunuhu.

SAM M. SPENCER.

In and for the District of South Kohala.

AUGUST AHRENS.

In and for the western part of the District of Hamakua, extending to the boundary of the land of Paauhau.

JAMES GIBB.

In and for that portion of the District of Hamakua, extending from the western boundary of the land of Paauhau to the boundary of the land of Kukaiau.

ALBERT HORNER.

In and for that portion of the District of Hamakua, extending from and including the land of Kukaiau to the Hilo District line.

JOHN M. ROSS.

In and for that portion of the District of Hilo, extending from the Hamakua District line to the land of Makahanaloa.

JOHN T. MOIR.

In and for that portion of the District of Hilo, extending from and including the land of Makahanaloa to the land of Kikala.

JOHN A SCOTT.

In and for that portion of the District of Hilo, extending from the Puna District line to and including the land of Kikala.

JOHN WATT.

In and for the District of Puna.

WILLIAM G. OGG.

In and for that portion of the District of Kau, extending from the Puna District line to and including the land of Punaluu.

CARL WALTERS.

In and for that portion of the District of Kau, extending from the land of Punaluu to the Kona District line.

R. VON S. DOMKOWITZ.

In and for that portion of the District of Kona, extending from the Kau District line to and including the land of Kaapuna.

T. C. WHITE, *Acting*.

In and for that portion of the District of Kona, extending from the land of Kaapuna to and including the land of Hookena.

JOHN D. PARIS.

In and for that portion of the District of Kona, extending from the land of Hookena to and including the land of Kaawaloa.

T. C. WHITE.

In and for that portion of the District of Kona, extending from the land of Kaawaloa to and including the land of Kahaluu.

JOHN A. MAGUIRE.

In and for that portion of the District of Kona, extending from the land of Kahaluu to the Kohala District line.

FOREST RANGER.

DAVID KAPIHE.

In and for that section of the District of Kona, Island of Oahu, bounded on the east by Manoa Valley, on the north by the Konahuanui Mountain Range, on the west by Nuuanu and Pauoa Valleys, and on the south by the makai edge of the Eucalyptus forest, the Makiki reservoir and the mauka boundary of the Judd land in Makiki and Manoa.

Preliminary Report of the Territorial Conservation Commission of Hawaii.

Honolulu, Hawaii, Nov. 14th, 1908.

Honorable W. F. Frear,
Governor of Hawaii,
Honolulu, Hawaii.

Sir:—The Territorial Conservation Commission of Hawaii has the honor to submit herewith a preliminary report on the nature and present condition of the natural resources of the Territory, together with certain recommendations looking to their proper development and wise use.

The duty of the Commission is to inquire into the natural resources of the Territory, to bring together the available information in regard to their present condition, and in coöperation with the National Conservation Commission and the Conservation Commissions of other states and territories to assist in formulating plans whereby the material resources of the Nation as a whole and of this Territory in particular may be wisely and conservatively used "in such a way as to promote the greatest good of the greatest number for the longest time."

The whole economic fabric of the Territory of Hawaii is closely bound up with the right use of its natural resources. Although politically an integral part of the Union, in situation Hawaii is remote from the other states and territories. Notwithstanding this fact even a casual inspection of the local problems of conservation shows that the majority of them are shared in common by Hawaii and by mainland states. The possibility of any extensive development of the resources of Hawaii depends on the continued prosperity of the mainland. The prosperity of the mainland rests in turn on the wise use of the sources of national wealth. Consequently both because of its own local problems and because of the relation that the wise use of the resources of the mainland bears to the question, Hawaii takes a real and vital interest in Conservation and in all that pertains thereto.

The natural resources of Hawaii are waters, soils and forests. Minerals can at present hardly be said to claim a place in the list, although recent developments in the making of lime from coral sand are an indication that as the result of a comprehensive investigation cement making and perhaps other industries dependent on mineral wealth could also be developed. Incidentally it may be remarked here that certain red earths, not uncommon in

the Territory, have long been used locally in the preparation of paints.

Hawaii is essentially a country dependent on agriculture. From its geographic position, its sub-tropical climate, and the peculiarities of its topography, irrigation plays a large and increasingly important part in the economic development of the Territory. The main industry is the production of sugar cane. Of the fifty odd sugar plantations over half are irrigated. On the non-irrigated plantations much water is needed for fluming cane to the mill or for power development. Other important industries are the growing and canning of pineapples, the production of rice, coffee, sisal and bananas, and cattle grazing. Rubber and tobacco give promise of good returns if rightly handled.

Waters.—For the successful development of all these industries water is needed in larger or smaller quantities. In many cases this necessitates a supply artificially procured. There have already been built, wholly by private enterprise and at private expense amounting to over \$15,000,000, elaborate irrigation systems to supply water for the irrigation of the sugar plantations. But as yet only a part of the water that could be turned to account is utilized. In the harnessing of the streams to produce power much also remains to be done.

Naturally the first step in a more complete and rational utilization of this great source and producer of wealth is an accurate and exhaustive examination of the water resources of the Territory. In the judgment of this Commission the need for such a survey by competent water experts is the most pressing necessity in the way of Conservation work, for on the possibility of bringing more water onto the land depends the whole future development of the Territory.

There are no navigable streams in the Territory of Hawaii. The value of water centers in its use for irrigation and power development.

Forests.—The primary value of the forests of Hawaii is that they serve as a protective cover on the steep, short water sheds of the streams needed for irrigation. This use was early recognized and has led to the setting apart of forest reserves—at first by private owners and later, during the last five years, under the direction of the Territorial Government. At the present time the total area of existing forest reserves is 444,116 acres, or about one-tenth of the total area of the Territory. Later it is expected considerably to increase the area so set apart.

In certain of the leeward districts, where the question of stream protection does not enter, the Hawaiian forest has commercial value, and is being systematically exploited. The principal products are Ohia Lehua railroad ties and Koa lumber—in the

trade called Hawaiian Mahogany—a fine grained, rich-colored hardwood, of value for interior finish and cabinet work.

The forest work of the Territory is carried on by technically trained men, Hawaii being one of the eleven States of the Union to employ a professional forester.

Lands.—Outside of the lands now under cultivation and those that should be kept permanently under forest there are considerable areas that with the application of water could unquestionably be made of high productive value. This class of land is now used principally for cattle grazing. In the aggregate it includes many thousand acres. It would appear that much of it is susceptible of reclamation for some more intensive form of agriculture. Here again the present need is for a thorough and careful study by experts. It should first be ascertained how much of this class of land can be brought under irrigation and second for what purposes it is best adapted if an adequate water supply were once assured. This indicates that along with a hydrographic survey there should also be a soil survey and a systematic classification of the land according to the uses to which it is best adapted. Such investigations pave the way for the incoming of the man who can successfully establish a home and build up a self-sustaining industry.

In addition to the lands that can be reclaimed through irrigation there are in Hawaii large tracts of waste land, such for example as areas covered by comparatively recent lava flows. Much of this class of land must always remain as waste land but portions of it are probably susceptible of being turned to useful account. A systematic classification of all lands would be a long step in this direction.

ORGANIZATION AND WORK OF THE COMMISSION.

The Territorial Conservation Commission of Hawaii was appointed by Governor Frear on July 23rd, 1908. Upon the organization of the Commission at a meeting held on July 31st, 1908, it was decided to take up the investigation through committees, as follows:

Forests: Messrs. Hosmer and Gartley.

Waters: Messrs. Gartley and W. O. Smith.

Lands and Soils: Messrs. J. G. Smith and Dillingham.

The several committees at once set about getting statistics and other information. Some of these data are submitted herewith in the form of appendices. Other data are not as yet in shape to be given out but will form the subject of a later report. The statements made in the appendices, while accurate as far as they go are therefore to be considered as preliminary only and subject to amplification.

It is perhaps not surprising that it has taken longer to collect accurate information concerning the natural resources of the Territory and their present condition than was at first anticipated. Many of the figures essential to such a compilation were found not to be available or only obtainable after extended inquiry. This condition has brought home to the Commission the extreme desirability of having in Hawaii some Territorial official charged with the duty of compiling statistics. In almost all the lines of inquiry before the Commission it should be possible to get facts and figures but as it is now the desired data are only to be had from individuals and corporations. There is no impropriety in the making public of the greater part of these data, nor are the corporations who have them unwilling to let them be so used. If there were a Territorial Statistician to attend to the collection of these and similar data valuable information on many subjects which it now takes weeks of labor to obtain would be available for instant reference.

RECOMMENDATIONS.

As a result of the study that has so far been made the Territorial Conservation Commission of Hawaii is unanimously of the opinion that for the best interests of the Territory there is urgent need of action looking to the conservation and more systematic use of the natural resources of the Territory.

To this end the Commission makes the following recommendations:

First. That active steps be taken to secure from the Territorial Legislature at its coming session an appropriation of not less than \$5,000 per year for a topographic and hydrographic survey of the Territory of Hawaii, to be made by the U. S. Geological Survey.

Following the usage customary in such coöperative agreements, the appropriation should be made contingent on the expenditure of an equal sum by the Federal Government. Such a survey would serve as a basis for a later and more extended study of the problems of reclaiming the many thousand acres of potentially agricultural land that require irrigation for successful development.

It is further recommended that this project be brought to the attention of the proper departmental authorities in Washington in such a way as to attract their interest and support.

Second. That there should be undertaken under the auspices of the Territorial Government a careful and thorough classification of the public lands of the Territory, with especial reference

to the adaptability of those not now under cultivation for use in the development of diversified industries.

Third. That further to make available accurate information of assistance to prospective settlers and others appropriate action be taken to secure the extension to Hawaii of the soil survey conducted by the Bureau of Soils of the United States Department of Agriculture.

Fourth. That in view of the fact that the successful development of diversified industries in Hawaii depends in large measure on making the agricultural lands accessible, the importance of goods roads and other means of inland transportation be emphasized.

In Hawaii there are no internal waterways to assist in transportation. Consequently it is the more necessary that adequate appropriations be made by the Territorial and local authorities for the building and up-keep of the principal and secondary roads.

Fifth. That an appropriation be secured at the coming session of the Legislature for a Territorial Statistician.

Such an official should properly be attached to one of the existing departments. The salary should be sufficient to secure the services of a capable person and provision should be made for a certain amount of clerical assistance.

Sixth. That a systematic attempt be made to develop and more firmly establish diversified industries in the Territory.

To this end the Hawaii Experiment Station should receive not only the moral but the financial support of the Territory, in order that it may enlarge the scope of its work, particularly in the way of establishing local demonstration areas.

Very respectfully,

RALPH S. HOSMER,
WILLIAM O. SMITH,
A. GARTLEY,
W. F. DILLINGHAM,
JARED G. SMITH,

Territorial Conservation Commission of Hawaii.

Appendix "A."

REPORT OF THE COMMITTEE ON FORESTS.

Honolulu, Hawaii, Nov. 14th, 1908.

For a clear undertaking of the forest situation in Hawaii it is necessary that one be acquainted with the conditions of topography and local climate. Lying in the belt of the northeast trade winds and being mountainous it follows that the Hawaiian Islands have a climate characterized by contrasts. On the windward slopes of the mountains is an area of high precipitation; in the leeward districts scant rainfall, even approaching aridity, is the rule. These facts coupled with the remarkable porosity of the soil, due to its volcanic origin, have a very direct bearing on the forest situation.

There are two main classes of forest in Hawaii. Both are of economic value; one because it helps to conserve the water needed for irrigation, power development and domestic supply, the other because it produces wood and timber. The forests of the former class are as a rule situated on the moist, windward slopes of the higher mountains. They are essentially "protection forests" in that their main value rests in the water that can be got from them. Those of the latter class, the commercial forests, are found in the districts where because of the absence of running streams watershed protection does not figure. The forests of the first class are by long odds the most important, for in Hawaii the relation between sustained stream flow and a watershed protected by a forest cover is intimate and peculiarly direct.

Hawaii is a country essentially dependent on agriculture. The main crop is sugar cane. On more than half of the 54 plantations irrigation is essential for successful cultivation, for although the soil in the leeward districts is rich it requires water to be made commercially productive. Water is also needed on the non-irrigated plantations for the development of power and the fluming of cane. The important part that irrigation plays in Hawaii may perhaps be made more apparent by the statement that over fifteen million dollars has been expended, wholly by private enterprise, in developing the irrigation systems that supply water to the cane fields of the irrigated plantations.

The importance of the forest is generally recognized in Hawaii and has led to a strong public sentiment in favor of forestry. This finds expression in a Territorial Forest Service charged with the creation and administration of forest reserves and with the prosecution of other forest work. During the past five years

under a definite forest policy systematically followed sixteen forest reserves have been set apart, with an aggregate total area of 444,116 acres. Of this area 273,912 acres, or 61 per cent., is land belonging to the Territorial Government. The other 39 per cent. is in private ownership but for the most part the owners of the lands, fully aware of the benefits of forest protection, coöperate actively with the Territorial Government in the management of the forest reserves.

There are three main types of forest in Hawaii, the Koa and Ohia forest lying between the elevations of two and six thousand feet; the Mamani forest, a pure stand of another native Hawaiian tree found on the upper slopes of the higher mountains; and the introduced Algaroba forest, which occurs at the lower levels on the leeward side of each of the larger islands.

The typical Hawaiian forest is of the first type. The forest consists of a dense jungle of trees, high growing shrubs, tree-ferns and climbers, with much undergrowth and a heavy ground cover of ferns and bracken. Altogether it is a plant community admirably adapted for the conservation of moisture, for preventing erosion and for serving as a reservoir to feed the springs and streams that rise within its bounds. The most important trees are Ohia Lehua (*Metrosideros polymorpha*) and Koa (*Acacia koa*).

The forest in all the forest reserves is of this type. A recent compilation of the forest areas of the Territory shows that the Koa and Ohia forest covers approximately 1,175,000 acres. Of this area it is estimated that eventually about three-quarters of a million acres will be included within forest reserve boundaries, of which about 70 per cent. will be Government land.

Above the level of the Koa and Ohia forest, on the slope of Mauna Kea (elevation 13,825 feet), on the Island of Hawaii, is found a nearly pure stand of another native Hawaiian tree, Mamani (*Sophora chrysophylla*). This forest occurs in a belt lying between the elevations of 6,000 and 8,500 feet. The area of the Mamani forest on Mauna Kea is 63,500 acres. Mamani occurs elsewhere in the Territory but does not at the present time form what may be called forests. It is, however, spreading rapidly so that in future years it will play a much larger part than it does now.

Mamani makes excellent fence posts, for which purpose the trees in the upper forest belt are cut for local use. No accurate figures as to the number cut are now available. Otherwise this type of forest is unimportant commercially.

The Algaroba (*Prosopis juliflora*) is the Mesquite of the Southwest. This tree was introduced into the islands in 1837. It has now spread so as to cover between fifty thousand and sixty thousand acres below an elevation of 1,000 feet in the leeward districts

of the larger islands of the group. It is spreading rapidly along the leeward coasts and is also gradually climbing to a higher elevation.

The Algaroba forest is the largest single source of fuel supply in the Territory. It is estimated that over 3,000 cords are sold annually in Honolulu. The price varies from \$12 to \$14 a cord, delivered.

The Algaroba forests are further of value because the pods make good stock feed and also because the tree is one of the important plants locally for bee food. It is estimated that for the calendar year 1907, the total amount invested in apiaries and other equipment for the manufacture of Algaroba honey was \$125,000 and that the gross receipts for Algaroba honey products for the year were over \$25,000.

It has already been shown that the primary value of the Hawaiian forest rests in the influence it exerts on the conservation of water and that the commercial aspect relatively takes second place. But in the leeward districts on the Island of Hawaii are considerable areas where owing to the great porosity of the soil there are no permanently running streams. Here the main value of the forest rests in the wood and timber that it can be made to produce. The two Hawaiian woods of commercial importance are Koa and Ohia Lehua. Both are heavy, close-grained hardwoods. Koa is used for interior finish, furniture, cabinet work and veneering. It is now sold in the markets of the American mainland under the name "Hawaiian Mahogany." Ohia is valuable for railroad ties. The systematic lumbering of this class of Hawaiian forest began in October, 1907, when a contract for ninety million board feet of Ohia railroad tie material was made between a local company and the Santa Fé Railway.

A tie mill with a daily capacity of 2,500 ties has recently been erected. The first regular shipment of ties is about to be made. No accurate estimates either of the amount of timber or the exact area covered by forests of the commercial class have yet been made, but the area is sufficient and the stand heavy enough to justify the continuation of lumbering operations for a considerable time.

The fact that none of the native trees in Hawaii furnish construction timber has led to extensive tree planting, both by the Territorial Government and by private interests. This work has been going on for the last thirty years and is constantly increasing in extent and importance. The trees principally planted are several kinds of Eucalyptus, the Australian Ironwood and Silk Oak and the Japanese Cedar. Wood and timber cut from the planted forests in Hawaii is now being used for fence posts, railroad ties, bridge timbers and wagon work. Practically all the construction

timber used in Hawaii is imported from Puget Sound and Northern California, mainly Redwood and Northwest (Douglas Fir).

In the reports of the U. S. Department of Commerce and Labor it is stated that for the fiscal year ending June 30th, 1907, there was imported into Hawaii from the mainland thirty million six hundred and three thousand feet, board measure, of timber boards and planks, valued at \$565,425.00. For the same year 17,476,000 shingles, valued at \$39,207.00 and other unmanufactured lumber to the value of \$116,756 were also imported, making in all a total of \$721,388.00 for unmanufactured wood products. The value of manufactured wood products imported during the same fiscal year was \$214,648.00. Further comment on the desirability of doing even a little towards securing a local source of supply is unnecessary.

It may perhaps be pertinent in closing this statement to note that a forest fire law similar to that of California was enacted by the Territorial Legislature at the Session of 1905. The Territorial Superintendent of Forestry is *ex officio* Chief Fire Warden and provision is made for a corps of District Fire Wardens to be paid for duty actually performed.

As a matter of fact plantation managers and other influential citizens agreed to take these positions without remuneration. The law provides penalties in case of damage resulting from the careless or malicious use of fire. Since its enactment there have been few fires of consequence, due in part to a better public sentiment created by the presence of the law on the statute books and to the interest aroused in the matter at the time of the enactment of the law.

Following is a table showing the names, locations, dates of proclamation and areas of the 16 forest reserves so far established in the Territory of Hawaii.

RALPH S. HOSMER,

A. GARTLEY,

Committee on Forests.

FOREST RESERVES, TERRITORY OF HAWAII.

Arranged in Chronological Order.

(Corrected to October 31, 1908.)

No.	Name.	District.	Island.	Total Area		Area Gov- ernment Land.	Area Private Land.	Date of Proclamation.	Proclamation Signed by.
				Recom- mended to be Reserved.	Acres.				
1	Kaipapau.....	Koolanloa	Oahu	913	913			Nov. 10, 1904	G. R. Carter
2	Hamakua Pali.....	Hamakua	Hawaii	18,940	16,333	2,607		Dec. 23, 1904	"
3	Hilo.....	Hilo	Hawaii	110,050	60,223	49,727		July 24, 1905	A. L. C. Atkinson
4	Koolau, Maui.....	Koolau and Hamakualoa	Maui	2,969	30,230	12,739		Aug. 24, 1905	"
5	Halelea.....	Halelea	Kauai	37,500	10,990	26,510		Aug. 24, 1905	"
6	Kealia.....	Puna	Kauai	9,935	7,385	2,550		Mar. 9, 1906	"
7	Ewa.....	Ewa, Waianae and Waialua	Oahu	28,550	5,151	23,399		Mar. 9, 1906	"
8	Honouliuli.....	Kona	Hawaii	665	665			April 4, 1906	"
9	Kau.....	Kau	Hawaii	65,850	59,618	6,232		Aug. 2, 1906	G. R. Carter
10	Waianae.....	Waianae	Oahu	3,237	3,150	107		Sept. 7, 1906	"
11	Luahalei.....	Waianae	Oahu	3,743	3,743			Nov. 30, 1906	"
12	Hana.....	Hana	Maui	14,825	13,767	1,058		Nov. 30, 1906	"
13.	Na Pali-Kona.....	Na Pali and Kona	Kauai	60,540	40,650	19,890		June 12, 1907	A. L. C. Atkinson
14	West Maui.....	Lahaina, Kaanapali and Wai- luku	Maui	44,440	19,105	25,335		April 21, 1908	W. F. Frear
15	Makawao.....	Hamakuapoko	Maui	1,796	1,796			April 21, 1908	"
16	Waialea Spring.....	Kona	Hawaii	193				April 21, 1908	"
Grand Total on October 31, 1908.....				444,116	273,912	170,204			

Appendix "B."

REPORT OF THE COMMITTEE ON WATERS.

Present and Prospective Use of Water for the Development of Power in the Hawaiian Islands.

Honolulu, Hawaii, Nov. 14th, 1908.

In considering the conservation of the resources of this Territory the possibility of the development and utilization of water power should be given very serious consideration.

At the present time a few developments have been made which are of considerable economic value and there are great possibilities for future development. At the present time practically all the water power is in use generating electric power to supply motive power for irrigating pumps, the most important one being the Kauai Electric Company on the Island of Kauai, where two twelve hundred kilowatt generators are installed in Wainiha Valley, utilizing some forty million gallons per day at a head of 575 feet. Power is transmitted 35 miles to the McBryde Sugar Company's plantation and there utilized in operating six multiple-stage centrifugal pumps direct connected to motors of an aggregate horsepower of 4,000. These pumps have a capacity of 31,000,000 gallons at a head of 175 to 400 feet, thus serving to irrigate over 3,000 acres of cane.

At Kekaha, Kauai, water is taken from a high level irrigating ditch and dropped 275 feet to irrigate the low level lands. At this point a six hundred kilowatt generator is installed to furnish power for four motors direct connected to multiple-stage centrifugal pumps having an aggregate horsepower of 700, the pumps having a capacity of 7,000,000 gallons at a head of 300 feet. The water for these pumps is taken from an irrigating ditch and pumped to a level above the ditch, thus rendering 700 acres of good cane land available.

The Pioneer Mill Company, at Lahaina, Maui, has installed a 250 kilowatt generator operated by water power which furnishes current for 200 horsepower motor operating a triplex reciprocating pump, which delivers 9,000,000 gallons of water against a head of 100 feet.

The Oahu Sugar Company, on the Island of Oahu, takes water from an irrigating pipe line and develops 120 kilowatts, which supplies a 100 horsepower motor direct connected to a centrifugal pump.

The Makee Sugar Company, at Kealia, Kauai, has installed and in operation a 300 kilowatt generator supplying current to a 225

horsepower motor operating a reciprocating pump having a capacity of 2,800,000 gallons of water against a head of 250 feet.

The Waianae Sugar Company, on the Island of Oahu, has installed two 200 kilowatt generators supplying current to motors of 375 horsepower to pump six and a half million gallons of water against a head of 150 to 280 feet.

The Hilo Electric Light Company, on the Island of Hawaii, develops 750 horsepower to operate generator of an aggregate capacity of 450 kilowatts to supply light and power for the City of Hilo.

The Territory of Hawaii has installed and in operation in Nuuanu Valley, Island of Oahu, water power driven generators of 400 kilowatts capacity for supplying arc lights and Territorial Government lighting in the City of Honolulu.

There are several small water power developments in mills varying from 10 to 50 horsepower which are used for operating machinery or electric generators.

The aggregate horsepower of these developments is approximately 6,500 horsepower.

It is impossible to make an estimate of the prospective power development and at best only a few can be mentioned. These are such powers as have been rendered available through partial developments made for irrigating purposes or where the possibilities are self evident. The conservation and development of water at high levels for irrigating purposes will render many other plants both possible and expedient. A close approximation of the ultimate possibilities can only be made when complete surveys of the watersheds, records of the rainfall and the cost and economic value of the developments are obtained.

The Island of Kauai presents a fertile field for future development and there are at the present time some 2,000 horsepower additional at Wainiha which is not being utilized; possibly 4,000 horsepower at Hanalei, and 1500 or 1800 horsepower at Makaweli, 500 or 600 horsepower at Hanapepe, and by the development of reservoirs back of Waimea, Wahiawa, Koloa, Wailua, Kapaa, Anahola and Kalihiwai several hundred horsepower can be made available.

On the Island of Oahu possibly 2,000 horsepower can be developed at Wahiawa and from the new high level reservoir in Nuuanu Valley.

On Maui the Hawaiian Commercial & Sugar Company at Kanai and in Iao Valley can develop about 2,500 horsepower; and there are several hundred horsepower available at Waihee in the development of the Wailuku Sugar Company. Some 1,200 horsepower could be rendered available at Lahaina from the development of the Pioneer Mill Company.

The power resources of the Island of Molokai are practically undertermined.

On the Island of Hawaii it is estimated that in the Waipio Gulch some 8,000 horsepower can be rendered available by the present irrigating ditch development and on the north coast from Waipio to Hilo there are large quantities of water going to waste or in use for fluming cane which could be developed. No estimate of the amount of this power is available, but it would amount to several hundred horsepower.

Storage capacity constructed in the Kohala Mountains would render power available, but at present the quantity is entirely undetermined.

At many places the permanency of the flowing streams is not assured, but the development of storage capacity would render the power secure and in many cases would increase the estimate of the amount available. However, the broken character of the country where these powers are available and the limited amount of arable land and water available for this land makes the economic value of the development of these powers questionable.

The production of fertilizers from atmospheric nitrogen by the use of electricity may render the water power extremely valuable at such places where the power cannot be used for pumping water for irrigating purposes.

A. GARTLEY,
W. O. SMITH,
Committee.

Appendix "C."

HAWAIIAN SUGAR PLANTATION STATISTICS.

Honolulu, Hawaii, Nov. 14th, 1908.

The enclosed Crop Reports for the year ending September 30th, 1908, show the number of tons of sugar produced on the sugar plantations in the Territory of Hawaii, by plantations and islands, and the names of the various agents and also the tons of sugar produced on each plantation for each of the ten years from September 30th, 1899, to October 1, 1908, inclusive.

The average yield of sugar per ton for all of the plantations was in 1906, 8,945 lbs. per acre, or, in round numbers, $4\frac{1}{2}$ tons; the average of the irrigated plantations was 11,526 lbs., or $5\frac{3}{4}$ tons; and the average of the unirrigated plantations was 6,140 lbs., or a trifle over 3 tons per acre.

The total area of the land in these islands is 4,127,360 acres.

Of this amount 200,000 acres are under cultivation in sugar, of which about 105,000 acres are irrigated and 95,000 acres are unirrigated.

Of the irrigated plantations about 1,000,000 gallons of water is applied per day to each 100 acres of land. To December, 1906, the cost of the irrigation systems of the several plantations was \$14,069,804.88.

A little over \$2,000,000 is expended each year for fertilizers. An average of about \$4.65 for each ton of sugar produced, and \$22.20 per acre for the crop.

It must be borne in mind that from eighteen to thirty months is required to mature a crop of sugar cane, so that the number of acres cultivated for each crop does not represent the total area under cultivation. For the crop of 1906, 96,228.6 acres were cultivated, producing 430,368.2 tons.

The plantation companies are nearly all incorporated, and the shares of stock are held by about 7,000 stockholders.

Note:—As many of the readers of this report have already seen copies of the printed tables issued by the Hawaiian Sugar Planters' Association, it is only necessary here to give the totals by islands, as follows:

IO HAWAIIAN SUGAR CROPS, 1899-1908, FROM SEPTEMBER 30, 1899, TO OCTOBER 1, 1908.

	1899 *Tons	1900 Tons	1901 Tons	1902 Tons	1903 Tons	1904 Tons	1905 Tons	1906 Tons	1907 Tons	1908 Tons
Hawaii	117,239	115,224	134,618	121,295	170,665	122,865	126,405	137,750	143,891	180,159
Maui	54,389	57,347	58,349	56,726	84,776	77,985	100,434	102,960	104,772	122,629
Oahu	45,820	53,625	99,534	107,870	121,066	102,019	123,095	113,750	119,273	137,013
Kauai	65,359	63,348	67,537	69,720	61,484	64,606	76,314	74,753	72,081	81,322
Total	282,807	289,544	360,038	355,611	437,991	367,475	426,248	429,213	440,017	521,123

* 2000 Pounds to the Ton.

Appendix "D."

PRODUCTION OF LIME ON THE ISLAND OF OAHU.

Honolulu, Hawaii, Nov. 14, 1908.

The Waianae Lime Company has 305 acres of land at Waianae, Oahu, from whence limestone is brought to Honolulu in raw state by cars of the Oahu Railway & Land Company and delivered at kilns situated at Iwilei adjacent to the oil tanks. At Iwilei the plant consists of cooper shop, barrel warehouse, lime warehouse and kiln building. Kilns are two in number, known as Schneider Patent Upright Kilns, are equipped with forced draft and have capacity of two hundred and seventy-five barrels per day. Lime is of high calcium quality and averages 97.20 pure, and is mostly used for fertilizer on sugar plantations.

Hawaii.

[A STATEMENT PREPARED FOR PRESENTATION AT THE CONFERENCE OF THE GOVERNORS HELD AT WASHINGTON, D. C., IN MAY, 1908.]

BY HON. WALTER F. FREAR, *Governor of Hawaii.*

Even the most far reaching problems may often be illumined and sometimes solved by observation or experiment upon a small scale. The laboratory, by its processes of bringing forces into clear relations, may in a moment disclose principles that centuries of national or world-wide experience have left unsuspected. Little, distant Hawaii, now an integral part of the Union as a full-fledged Territory, has been, even since the beginning of Christian civilization there less than a century ago, a veritable laboratory of industrial as well as sociological experimentation under conditions that have seemed almost artificial in the clearness of the relations of the operative forces. It may be that she can shed light, at least by way of illustration, upon some of the needs, methods, and means involved in the all-important national questions presented to the Conference.

I will present but two points. The first is the marvelous results of the application of science to agriculture. That has been in large measure the making of Hawaii industrially.

That Territory is a group of lofty islands of recent volcanic origin, within the tropics, remote from the world's markets. Practically without mineral resources, she is dependent mainly upon her soils; but, although nearly as large as Connecticut and Rhode Island combined, so much of her area is so high or so precipitous or so recently formed or so dry or otherwise unsuited to marketable crops that only a very small percentage can be classed as arable in its natural condition and in the present state of knowledge. Obviously, if she is to support a large population, science must do what nature has left undone, and accordingly perhaps nowhere else is science now being more resorted to for agricultural purposes, and yet only a beginning has been made.

The limited extent of arable public land in Hawaii—and comparatively speaking now on the mainland—calls for the greatest care in its disposition. Adequate precautions should be taken to insure its disposition in general only to bona fide settlers and in not larger quantities to each than can be put to best use; and until

a superior use can be found for the large areas still held as public land for which no such use is known at present, they should in general be retained or disposed of only temporarily by lease or otherwise, until a superior use is discovered for them. Hawaii's experience in earlier liberal disposition of the lands and later discoveries of superior uses emphasizes the need of such precautions.

Until a few years ago attention in Hawaii was directed almost exclusively to the production of cane sugar, which, in spite of various adverse natural conditions, has been brought by the application of science to the highest point of efficiency yet attained anywhere,—so much so indeed, that from her comparatively small acreage of cultivated land Hawaii will produce this year more than \$40,000,000 worth of sugar alone, or more than one-sixth of this country's consumption of that product, and her exports and imports, with this product as almost their sole basis directly and indirectly, will considerably exceed those of the entire United States at the time of the adoption of the Constitution.

Hawaii being within the tropics, the question of water is of superlative importance. The rainfall is abundant, ranging from a few inches to several hundred inches a year according to locality, but the more abundant fall is usually distant from the land where it is most needed. The problem is that of its conservation by way of preventing it from escaping immediately to the sea in freshets, and that of transferring it to the arid lands. It has been demonstrated that land which, with an ample supply of water properly applied produces, say, ten tons of sugar to the acre, produces only four-fifths of a ton under a rainfall of $32\frac{1}{2}$ inches a year. Most of the irrigated plantations have less than this amount of rainfall. One hundred and five thousand acres or about one-half of the 213,000 acres devoted to sugar production, only about one-half of which is cropped annually, is practically reclaimed arid land,—entirely through private enterprise. The reclamation of this land has involved an expenditure of about \$15,000,000 or more than \$140 per acre in initial outlay for the construction of ditch, tunnel, flume and pipe lines, reservoirs, pumping plants, artesian and surface wells and electric plants for the generation of power for pumping plants. A single system for one group of plantations includes about 225 miles of main and lateral ditches, tunnels, etc., costing a million and a half dollars, besides wells, reservoirs and pumping plants. In one instance, electric power is generated by water on the rainy side of the island for the operation of pumps on the opposite or dry side. There are 111 pumps in operation with a capacity of 580,000,000 gallons per 24 hours. Sixty per cent. of the water used on irrigated plantations is pumped. The average lift is 191 feet, with a maximum of 550 feet. One acre requires about 5,000,000 gallons per crop or about

10,000 per day. The expense is great but it is a necessity and it pays. The irrigated lands produce nearly twice as much as the unirrigated. Though constituting only half the total area they produce about two-thirds of the total output of 500,000 tons of sugar.

In view of the foregoing, the preservation and extension of forests are obviously prime necessities. The typical islands consist of a high central mountain with radiating ridges and valleys. From ancient times the islands have been subdivided in apple-pie fashion, the typical main division of land extending from seashore to mountain-top and comprising one or more valleys with their side ridges. Even in ancient times each valley had its own network of small ditches for purposes of irrigation. The water-sheds are short, the slopes, steep; there are few permanent springs; it is the forests that must be relied on to hold the water for the steady supply of the streams. The relation between the forests above and the near-by arable plains or gentle slopes below in respect to water supply is too obvious to be disputed. Before the possibilities and needs of irrigation became apparent, much wasting of the forests by cutting and through destruction by live stock was permitted, with most disastrous results, as it now appears. Accordingly, more than thirty years ago, steps were taken by legislation for the preservation and extension of the forests, but not until five years ago was a comprehensive statute passed creating an effective board of agriculture and forestry with adequate powers. Since then 444,000 acres have been set aside by 16 proclamations of the Governor on the recommendation of the Board as forest reservations, of which 61 per cent. is Government land, and within the next few years this area is expected to be extended to about 750,000 acres, or about 80 per cent. of the total forest area, of which about 70 per cent. will be Government land. Government and private lands are sandwiched in with each other and it is of the greatest importance that the Government and private owners coöperate with each other in this matter. Fortunately the need is so obvious and the methods of procedure have been of so friendly a nature that practically no difficulty has been experienced in obtaining the active coöperation of the private owners in the setting aside and fencing of reservations and the keeping out of live-stock. In addition to this nearly one-fourth of the sugar corporations besides many ranchmen and others, are actively engaged in tree planting. Only a comparatively small percentage of forest area or area available for forest on the mainland is in Government ownership. If forestry is to be carried to the extent desired it is essential that private owners be induced to coöperate with the Government or else that private lands be condemned for forest purposes. The principal means of bringing

about coöperation would seem to be education—a means which this conference will largely serve to effect and which is already being effected through many other channels.

It is not alone to the question of irrigation in connection with the sugar industry that science has been called upon to contribute. It has been called upon to contribute equally in almost every phase of that industry—in methods of manufacture and cultivation, fertilization, chemistry, entomology, plant pathology and physiology. More than \$2,000,000 is expended annually in the purchase of fertilizers, besides which large quantities not purchased are used. The cost of this item alone averages \$4.55 per ton of sugar or \$22.20 per acre per crop. The planters maintain an experiment station with a large corps of scientists, covering nearly every department of the industry, at an expense greater than that of any experiment station, public or private, on the mainland, with possibly one or two exceptions.

So much as to one industry by way of illustration of the value of the application of science to agriculture in all its aspects. Through the Federal Experiment Station, the Territorial Board of Agriculture and Forestry, and other mediums a good beginning has been made in the same direction in other industries with most promising results—in the pineapple, rubber, sisal, tobacco, and other industries. A college of agriculture has been established; instruction in agriculture as well as in the mechanic arts is made more and more prominent in the public schools, a beginning having been made in this direction as long ago as 1831 and 1836 when industrial training schools, the first in the United States, were established—which in large measure suggested to General S. C. Armstrong, who was born and brought up in Hawaii, the ideas which he later embodied in Hampton Institute.

The needs and opportunities are such that every effort must and will be made in Hawaii to perfect a science of tropical agriculture and build up a group of tropical agricultural industries to the highest point of efficiency to which they can be brought by the application of scientific methods. What is needed now, outside of transportation and other facilities, through the scientific branches of the Federal Government, is assistance in forestry and in soil, topographic and hydrographic surveys and branch experiment stations—so comparatively new is the field of scientific tropical industry and so unique are the conditions of wide variation in rainfall, temperature and soils within shortest distances in Hawaii.

The second point to which I wish to refer is that of the location of Hawaii at the commercial center or cross-roads of the Pacific—which, the greatest of oceans, between the richest of continents, is fast approaching the fulfillment of the long-ago prophecies of von

Humbolt, Seward and others, to the effect that it would eventually be the theater of the world's greatest commerce. If the inland waterways of the Mainland, especially those of the great Mississippi Valley are to be developed to the extent which seems likely in the near future, and if the Panama Canal is to be completed, as it must be, within a few years, not only is it a corollary that Hawaii must be provided with adequate harbor facilities in order to make these other great works serve most completely their purposes, but obviously one of the most effective methods of conserving the natural resources of the United States is by taking advantage of, through these provisions for adequate transportation facilities, the vast natural resources of other countries and especially those of China which are perhaps, next to those of the United States, the richest in the world and as yet practically untouched. The location of Hawaii, which thus far has proved one of the greatest obstacles to her industrial prosperity, will hereafter be one of her greatest assets, and with the proper development of her harbors through Federal aid she will, small though she is, have the proud honor of playing a part out of all proportion to her size in the conservation of the natural resources of the nation.

The Declaration of the Governors.

At the conclusion of the Conference of the Governors held at the White House in May there was unanimously adopted the following statement, which has come to be known as "The Declaration of the Governors." In a recent address President Roosevelt spoke of it as "a memorable declaration which should hang on the wall of every school, and every citizen who is a voter in the United States in the next generation should know about it."

The Declaration in full is as follows:

"We, the Governors of the states and territories of the United States of America, in conference assembled, do hereby declare the conviction that the great prosperity of our country rests upon the abundant resources of the land chosen by our forefathers for their homes and where they laid the foundation for this great Nation.

"We look upon these resources as a heritage to make use of in establishing and promoting the comfort, prosperity, and happiness of the American people, but not to be wasted, deteriorated, or needlessly destroyed.

"We agree that our country's future is involved in this; that the great natural resources supply the material basis upon which our civilization must continue to depend, and upon which the perpetuity of the Nation itself rests.

"We agree, in the light of facts brought to our knowledge and from information received from sources which we cannot doubt, that this material basis is threatened with exhaustion. Even as each succeeding generation, from the birth of the Nation, has performed its part in promoting the progress and development of the Republic, so do we in this generation recognize it as a high duty to perform our part, and this duty, in large degree, lies in the adoption of measures for the conservation of the natural wealth of the country.

"We declare our firm conviction that this conservation of our natural resources is a subject of transcendent importance, which should engage unremittingly the attention of the Nation, the states, and the people in earnest coöperation. These natural resources include the land on which we live, and which yields our food; the living waters which fertilize the soil, supply power, and form great avenues of commerce; the forests which yield the materials for our homes, prevent erosion of the soil, and conserve the navigation and other uses of our streams; and the minerals

which form the basis of our industrial life, and supply us with heat, light and power.

"We agree that the land should be so used that erosion and soil wash should cease, that there should be reclamation of arid and semi-arid regions by means of irrigation; that the waters should be so conserved and used as to promote navigation, to enable the arid regions to be reclaimed by irrigation, and to develop power in the interests of the people; that the forests, which regulate our rivers, support our industries, and promote the fertility and productiveness of the soil, should be preserved and perpetuated; that the minerals found so abundantly beneath the surface should be so used as to prolong their utility; that the beauty, healthfulness, and habitability of our country should be preserved and increased; that the sources of national wealth exist for the benefit of the people, and that the monopoly thereof should not be tolerated.

"We commend the wise forethought of the President in sounding the note of warning as to the waste and exhaustion of the natural resources of the country, and signify our appreciation of his action in calling this Conference to consider the same, and to seek remedies therefor through coöperation of the Nation and the states.

"We agree that this coöperation should find expression in suitable action by the Congress within the limits of, and co-extensive with the national jurisdiction of the subject, and, complementary thereto, by the legislatures of the several states within the limits of, and co-extensive with, their jurisdiction.

"We declare the conviction that in the use of the natural resources our independent states are interdependent and bound together by ties of mutual benefits, responsibilities, and duties.

"We agree in the wisdom of future conferences between the President, members of Congress, and the Governors of the states on the conservation of our natural resources with the view of continued coöperation and action on the lines suggested. And to this end we advise that from time to time, as in his judgment may seem wise, the President call the Governors of the states, members of Congress, and others into conference.

"We agree that further action is advisable to ascertain the present condition of our natural resources, and to promote the conservation of the same. And to that end we recommend the appointment by each state of a commission on the conservation of natural resources, to coöperate with each other and with any similar commission on behalf of the Federal Government.

"We urge the continuation and extension of forest policies adapted to secure the husbanding and removal of our diminishing timber supply, the prevention of soil erosion, the protection

of headwaters, and the maintenance of the purity and navigability of our streams. We recognize that the private ownership of forest lands entails responsibilities in the interests of all the people, and we favor the enactment of laws looking to the protection and replacement of privately owned forests.

"We recognize in our waters a most valuable asset of the people of the United States, and we recommend the enactment of laws looking to the conservation of water resources for irrigation, water supply, power, and navigation, to the end that navigable and other streams may be fully utilized for every purpose.

"We especially urge on the Federal Congress the immediate adoption of a wise, active, and thorough waterway policy, providing for the prompt improvement of our streams and conservation of their watersheds required for the uses of commerce and the production of the interests of our people.

"We recommend the enactment of laws looking to the prevention of waste in the mining and extraction of coal, oil, gas and other minerals with a view to their wise extraction for the use of the people, and to the protection of human life in the mines.

"Let us conserve the foundations of our prosperity."

DIVISION OF ENTOMOLOGY.

Report of Superintendent of Entomology.

BY JACOB KOTINSKY.

Honolulu, Hawaii, December 31, 1908.

Honorable Board of Commissioners of
Agriculture and Forestry of the
Territory of Hawaii.

GENTLEMEN :—I have the honor to present herewith the Fifth Report of the Division of Entomology covering the calendar year 1908.

STAFF.

Superintendent. The Division sustained severe loss in the death of its Superintendent, Mr. Alexander Craw, on June 28, 1908. He fell ill the preceding October and, failing to improve, he sailed by your leave for San Francisco on February 19 in hope of recovering his health. But contrary to hope he failed to rally.

Consulting Entomologist. Mr. Albert Koebele, I am happy to say, is in the service of the Board in capacity of consulting Entomologist, as heretofore.

Assistant Entomologist. During Mr. Craw's illness the writer attended to the work of inspection and shortly after his death was appointed to succeed him. The position of Assistant Entomologist thus made vacant still remains to be filled.

Inspector's and Other Assistants. By your leave the recent Inspector's Assistant, Mr. G. A. Jordan, spent three months in the Orient. During his absence he was substituted by Mr. R. W. Smith. Mr. Jordan having resigned August 15, Mr. D. B. Kuhns, a graduate of the Normal School and an ardent naturalist was appointed to the position. His very faithful service during the shortage of help is of inestimable value to the work of inspection. During several emergencies we employed temporarily, for a day or a day and a half at a time, an outsider

to aid in the clerical work in course of inspection of heavy cargoes. There were no other changes in the staff except that Bro. M. Newell was promoted commensurate with the scope of his work. The roll of our honorary inspectors, consisting of Messrs. R. R. Elgin at Mahukona, Hawaii; W. O. Aiken at Kahului, Maui; and W. D. McBryde at Koloa, Kauai, remains intact and ready to serve when occasion requires. Miss Ella K. Dayton is still clerk and stenographer of the Division, and her faithfulness to duty has not diminished.

ACKNOWLEDGMENTS.

We cannot pass on without making due acknowledgment for assistance given by several individuals and institutions. To the Division of Entomology and Plant Pathology of the Hawaiian Sugar Planters' Association Experiment Station, and especially to their respective directors, we are indebted for identification of material and repeated advice on matters pertaining to their respective specialties; to Dr. L. O. Howard and staff of the United States Bureau of Entomology for identification of material; to Major Casey for a similar service on several Coleoptera; to Mr. D. L. Van Dine for generously undertaking the onerous work of bee inspection; to Dr. E. V. Wilcox for coöperation in quarantine and advice on inspection method and policy; to the Public Works Department for the use of horse, and other favors; last but not least for the numerous courtesies and favors of vital importance to this Division received from United States Customs, Immigration and Postal officials of all grades from the respective chiefs down, and finally to steamship and agency officers the thanks of this Division are due.

LINES OF WORK.

As hitherto the work occupying most of our attention and time pertained to INSPECTION of live vegetable matter coming from abroad. We did not neglect BREEDING AND DISTRIBUTION OF USEFUL INSECTS and what laboratory work was most important. This was necessarily curtailed and fragmentary owing to the absence of a functioning Assistant Entomologist. Nevertheless, as will appear later, this end of the work was not without result. When requested, visits were made to gardens in and out of town and advice on methods of combating injurious insects was always freely given. We are also charged with the duty of collecting and delivering to destination what useful insects arrive from abroad.

INSPECTION, QUARANTINE AND DISINFECTION OF IMPORTED VEGETATION.

RECORDS. By means of a series of printed blanks specially devised for the purpose we are now able to keep accurate record of all vessels we board and cargoes we inspect. Each article under each consignee mark is checked and noted to indicate in no mistakable way the disposal of it and the causes thereof. These data are systematically arranged and kept on our permanent files ready for reference at short notice. By means of "Inspectors' Lists" printed in quantity, and freely distributed among importers who, in accordance with our law, are obliged to supply required data, we are able to keep strict watch of imports with regard to variety, origin and state of freedom from pests. Incidentally we keep record of imports of fruits and vegetables so that we are able to get good insight into the amounts of these consumed by the people of the Territory. If to these data we attach prices we get an approximate idea of our annual green good bill. (See p. 114.)

INSPECTION TABLE.

By means of the following table the quantities inspected, released with and without treatment, ordered returned or destroyed and the pests responsible for adverse treatment are shown in concise form.

TABLE I.—MONTHLY, TOTAL AND AVERAGE OF QUANTITY INSPECTED AND MANNER OF DISPOSAL.*

Month 1908	Number of Vessels	Parcels Examined and Action Taken									
		Refused landing	1	:	:	:	40	:	6	:	:
		Dipped in	Bordeaux	3 cases (5000) Asparagus roots for rust. Also all plants from Florida and Manila.							5000 47
			Formalin	19							54
		Destroyed	14	19	10	15	11	19	36	22	198
		Fumigated.....	14	19	10	15	11	19	36	22	198
		Fruits returned	14	19	10	15	11	19	36	22	198
		Potatoes returned.....	100	150	797	100	3	33	19	36	509
		Passed as free from pests	8726	7615	12411	8306	10612	6589	9920	11042	134631
		Total	8840	7802	13248	8409	10697	6641	10065	11154	143022
		Fruits and Vegetables	8818	7711	13089	8357	10560	6601	10013	11103	142104
		Plants	17	64	115	45	96	28	28	50	634
		Seeds	5	27	40	7	41	12	23	20	296
		Number of lots inspected.....	367	320	593	222	921	512	675	520	5916
		In ballast.....	Erskine Phelps to Kahului, S F. rock. Flaurence Ward, Midway sand (2). Wm Frye, San Francisco rock								4
		Bringing vegetable matter	14	21	29	17	15	16	23	15	216
		Boarded	27	26	36	31	34	31	30	25	345
		January	27	26	36	31	34	31	30	25	345
		February	27	26	36	31	34	31	30	25	345
		March	27	26	36	31	34	31	30	25	345
		April	27	26	36	31	34	31	30	25	345
		May	27	26	36	31	34	31	30	25	345
		June	27	26	36	31	34	31	30	25	345
		July	27	26	36	31	34	31	30	25	345
		August	27	26	36	31	34	31	30	25	345
		September	27	26	36	31	34	31	30	25	345
		October	27	26	36	31	34	31	30	25	345
		November	27	26	36	31	34	31	30	25	345
		December	27	26	36	31	34	31	30	25	345
		Total	345	216	29	18	29	18	29	18	29
		Average.....	29	18	29	18	29	18	29	18	29

* This does not include our inspector's work at Hilo. Owing to lack of proper blanks no adequate records were kept there until the last few months of the year, and these were not included. This applies to Table II as well. These tables do include, however, all vegetable cargo brought for Maui and Kauai.

**SUMMARY
OF TABLE.**

It will be gleaned from this table that on an average we boarded a vessel nearly every day of the year, and found matter for inspection on nearly two-thirds of them. Seeds, plants and fruits were traced in the mails, baggage and freight. On an average 576 lots were inspected each month. A lot varies from one parcel to hundreds, but no lot is passed upon before at least one parcel is inspected, often two or three, and in nearly every case of plants, each individual plant is examined most scrupulously. The total number of parcels examined is enormous and would be incredible, were it not known that they were examined by lots. These figures would doubtless be much more interesting and instructive if it were possible to compare them with similar tables.

SCABBY**POTATOES.**

As will be seen by reference to the table a large quantity of potatoes (2,388 sacks) was returned this year, all owing to scab and soil. In all this pest was held up seventeen times during the year. Potato scab (*Oospora scabies*) is a fungus disease affecting potatoes, beets, etc., giving the skin a rough, corky appearance, ultimately rotting the affected tuber. Practically all of the potatoes that come here from California are either so-called "Rivers" or "Salinas." The latter are more expensive but have thus far always been found clean and free from scab. The "Rivers" are so-called because they are grown in wet river-bottoms where unfortunately the growth of scab is also promoted so that most of these potatoes coming here are dirty with the adhering soil and very scabby. Their seeming cheapness is their only excuse, but even this is questionable as what is left of the tuber, after soil and scab are removed, costs no less than clean potatoes. What is worse, under the impression that any potato will do for seed, many of our citizens wishing to plant usually select the most scabby tubers for the purpose, thus inoculating the soil and spoiling their chances for getting a paying crop for years to come.

On these grounds it was deemed advisable to order returned all excessively infested and soil-covered "spuds." Such potatoes often come on consignment, i. e., are sent here by San Francisco shipping commissioners on speculation and, in the event of failure to pass inspection, pay the return freight.

GREEDY**SCALE.**

The quantity of fruit returned is also rather considerable and is largely due to the presence of this scale bug (*Aspidiotus rapax*) on apples. Pears and lemons are also included in the number returned on account of this scale. On the lemons we found purple and San Jose scales (*Lepidosaphes beckii* and *Aspidiotus perniciosus*) in addition. Altogether this pest was held up twenty-six times in course of the

year. Citrus fruits, on the other hand, were, on the whole very clean last year owing probably to the good influence of the California Citrus Union.

The greedy scale, as its name implies, is a very omnivorous insect. In the sections of California invaded it feeds on a large variety of plants and is quite injurious to fruit trees. It occurs also on these islands and thrives especially at higher elevations where it is destructive to a number of native trees of great economic value, such as Koa (*Acacia koa*) and Ohia (*Metrosideros polymorpha*). An additional supply of the pest can scarcely be beneficial. In view of the large quantities of these fruits imported it does not take many bugs to the apple to mount up in the thousands. In one instance within little over a month we were obliged to refuse admission to two large lots of apples sent from the same orchard in California. To the growers' complaint of our action we replied explaining our strict law. Following is a copy of their reply:

"....., Cal., December 3, 1908.

Mr. Jacob Kotinsky,

Honolulu, T. H.

Dear Sir:

Your letter of 18th ult. to hand, and contents carefully noted. In reply, we wish to thank you for your prompt reply and for your views in the matter of shipping fruit into your Territory. We understand that you are doing your full duty when attending to this business for your Territory, and we cannot blame you for enforcing the laws of your people. We believe that you are doing only what is your duty in the matter of inspecting fruit which is shipped to your city.

We will be very careful in selecting our fruit when we are shipping again to Honolulu and see that there is nothing shipped but first class fruit which is free from all insects and diseases.

Thanking you for your kind reply to our letter, we beg to remain,

Yours very truly,

(S)....."

**CABBAGE MAGGOT
IN TURNIPS.**

Very few lots of turnips passed muster last year, twelve having been condemned owing to infestation by cabbage maggot (*Phorbia brassicae*) and thick mats of soil on roots. To our knowledge this maggot has not yet been observed here and it is wisely kept out. Whenever soil alone was the fault soil being one of the prohibited articles, it was removed before releasing the roots. Various forms of the fly were so uniformly present on imported turnips during the last six months and their condemnation was equally so regular that shipments of this vegetable have practically ceased. The head ends of one lot of horse-radish roots were found infested with the same or a similar fly, and accordingly cut off and destroyed.

SOIL.

Soil is one of the most dangerous importations as a source of agricultural pests. It needs but be mentioned that our pernicious Japanese beetle (*Adoretus umbrosus*, var. *tenuimaculatus*) came to us hidden in soil in pots of imported plants. With this knowledge constantly in view we kept strict watch over imports of this article whether it came by the ship-load as ballast or in clots about roots of uncleaned vegetables, and especially about roots of growing plants. Unless free from pests beyond the shadow of a doubt the soil was removed and thrown into the fire. Some plants may have suffered in consequence, but severity was deemed wiser than to jeopardise our agricultural interests.

**FUNGUS INFESTED TARO,
SWEET POTATOES AND
YAMS FROM THE ORIENT.**

After careful survey of the situation we realized that, unless new arrangements are made, we will be unable to give the careful examination to vegetation from the Orient that is accorded matter coming from the other side. For a knowledge of the vegetable portion of the cargo the inspector until then depended upon a list supplied by an officer aboard ship or on a perfunctory examination of suspicious looking containers. The manifest, from which the ship's officer compiled the list for us, most often has matter subject to our inspection lumped under "Merchandise" along with other irrelevant objects. After consultation with the customs brokers we found them willing to prepare for us itemized statements copied from the invoice and the thanks of the service are due them for it. Armed with itemized lists we are able to make careful examination of each cargo, lot by lot. But owing to apparently inflexible regulations of the customs service we cannot make this examination before the stuff has entirely passed out of federal jurisdiction, so that we are obliged to spend an excessive amount of time on these cargoes in waiting for our turn. But

the condition of these imports as we found them upon careful inspection fully warrants this expenditure. Taro, sweet potatoes and yams were found in the majority of cases badly diseased. A plant pathologist was consulted and he confirmed the parasitic nature of the fungus submitted. Garlic was found badly infested with destructive caterpillars; sweet potatoes alive with all stages of the sweet potato borer (*Cylas formicarius*); fresh olives and citrus fruits coming contrary to our regulations, badly decayed and the latter heavily infested with a variety of scale bugs besides. All matter so infested was condemned and burned. It is gratifying that in accordance with a ruling of the United States Treasury Department the consignees whose imports are condemned by us have at least their duty refunded. Following is a copy of this ruling as embodied in the letter to the Collector of Customs, dated September 23, 1908:

“Authority is granted for you to permit the duly authorized territorial officers to inspect any trees, plants, fruits, etc., and if you shall be satisfied that such articles, if admitted would be actually injurious to persons or property, to refuse delivery of the same and to require their exportation, or in default of exportation, to obtain the authority of the court for their condemnation and destruction. When such articles shall have been exported or destroyed the estimated duties paid thereon will be returned to the consignee.”

DESTRUCTION. This is usually done by fire, rarely by throwing condemned articles overboard. Articles are burned only as an inevitable resort, and importers are usually given the alternative of returning condemned goods. Thus, fruit from the Orient or Australia is destroyed in accordance with Board regulations. Insect and particularly fungus-infested vegetables from the Orient are consigned to the flames. Cut flowers brought by passengers are often found infested with a variety of pests and, if abandoned by their owners, are burned. So are also badly decayed or wormy fruits or plants. Prussic acid gas cannot kill worms within fruit hence wormy fruit must be destroyed if not returned. Finally, potatoes from ports to which there are no direct return boats if condemned must be burned.

FUMIGATION. Except in case of infested seeds or grape vines, which are fumigated with carbon bisulfide, fumigation is done with hydrocyanic (or “prussic”) acid gas. The gas is produced by a mixture in definite proportions of cyanide of potash, sulfuric acid and water. The gas is a most violent poison to man and beast, tho to plants under certain conditions it is harm-

less. A plant, whose vitality is sapped by a horde of insect parasites distinctly manifests relief from these after fumigation.

In the majority of cases the inspector resorts to fumigation as a precaution, especially with plants in foliage, or plants coming from the Orient and Australiasia. Small lots of fruits infested with live scale bugs are also fumigated before being released. But there need be no fear to eat fruit so fumigated, as the gas is so light and volatile that 15 minutes after opening of the fumigating room all traces of it are gone.

**DIPPING IN
BORDEAUX
AND FORMALIN.**

Bordeaux mixture is invariably administered by us or under our direction to asparagus roots to forestall rust, and to growing plants in foliage, like mango and avocado trees from Florida, litchees from the Orient, etc., against possible unknown fungi. The formalin dip was twice applied during the year to seed potatoes to prevent appearance of fungus diseases afterwards.

**MAIL TO
OTHER
ISLANDS.**

Under present arrangements nothing escapes inspection by whatever channel it is consigned to Honolulu or Hilo. All freight consigned to ports on Maui or Kauai comes via Honolulu and is inspected here. But we are not certain of the status of mail matter contained in pouches addressed to post offices other than Honolulu or Hilo. Incidents as related by the late Mr. Craw on page 146 of the Board's Third Report would seem to point at least to the possibility of some things unavoidably slipping past us in the mails. A movement has already been set on foot to enlist the coöperation of proper authorities in Washington in the passage of two postal regulations: (1) Ordering all mail parcels containing live vegetable matter to be prominently labeled indicating their contents, and (2) all parcels for this Territory so labeled be dispatched in bags tagged Honolulu or Hilo, as the case may require. Such regulations, it is believed, will enable us to see everything sent here by mail. No definite result has yet been attained. But we should not relax our activity until the desired goal is reached.

**QUARANTINE OF
IMPORTED PINE-
APPLE PLANTS.**

Owing to the decayed condition of a lot of pineapple plants received from Australia sometime in 1903 the Board at the time passed a regulation prohibiting the importation of these plants from that part of the world. As a direct result our pineapple industry, tho prosperous, was limited to the cultivation of but one or two varieties. The application of a citizen for the privilege of importing plants of a new variety set up an inquiry which produced the information that (1) addition of

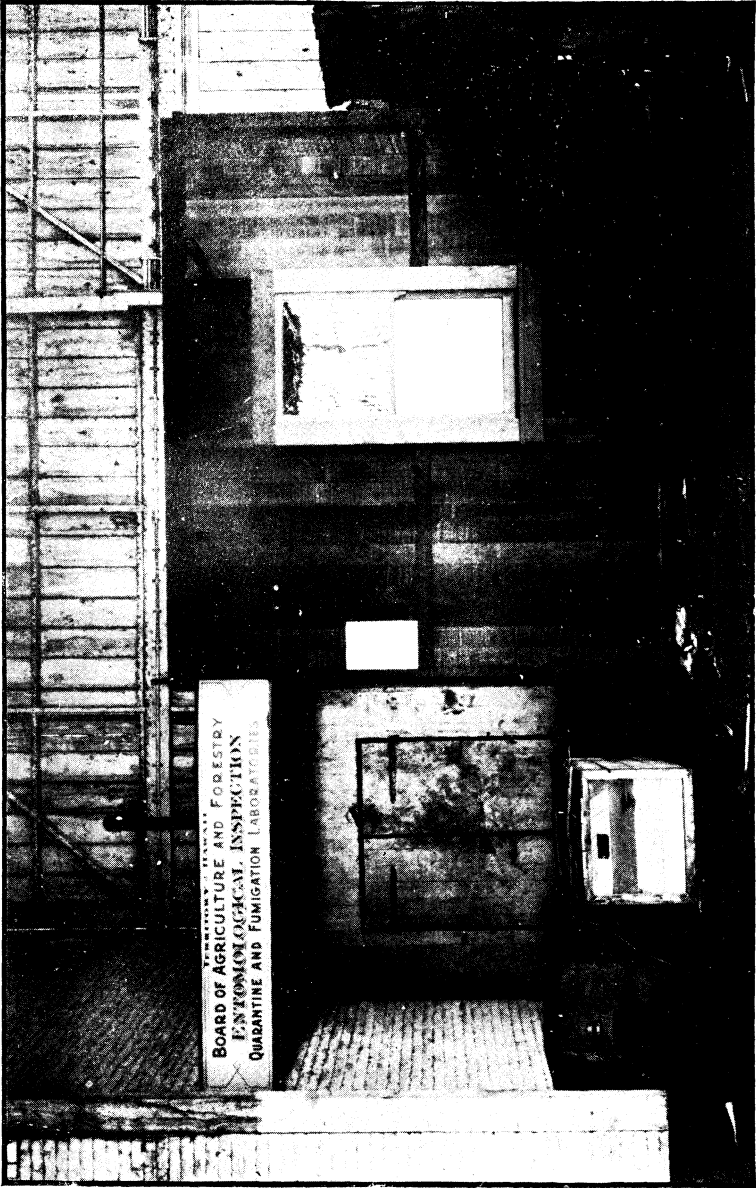
other pineapple varieties is very desirable; that (2) no destructive disease to pineapples in Australia is actually known and that finally (3) with our present facilities for disinfection we need but quarantine facilities to make such importations perfectly safe. Special Agent, Dr. E. V. Wilcox, having placed the facilities of the Agricultural Experiment Station at our disposal for this purpose we felt justified in recommending to the Board to so modify the 1903 pineapple regulation as to make the port of Honolulu an exception. The matter is pending action by the Board and Governor.

**REGULATION PERTAINING
TO HONEY AND HONEY
BEE INSPECTION.**

The existence of serious diseases of honey bees on the Mainland has been common knowledge at least to bee men for some time, as was also the belief that they have not yet been introduced to these islands. This belief was definitely confirmed by Dr. E. F. Phillips of the United States Bureau of Entomology who, during a recent visit, brought home to us the great necessity of taking steps to prevent the introduction of these diseases into Hawaii. The first step in this direction was taken by the Legislature, in 1907, who in its Act 69 (see page 115) clothed the Board with the necessary power to inspect, quarantine and if necessary destroy honey and bees coming to the Territory, since either may carry and transmit the disease. In accordance with this law the Governor approved Rules 4 and 5 of this Division regulating the importation of queen bees and honey respectively. (See p. 116.) As the Legislature in its appropriation failed to provide for the expense of bee inspection the Board was dependent on the good will of Mr. D. L. Van Dine, Entomologist of the Hawaii Experiment Station to do the work in connection with his bee investigations.

**QUARANTINE AND
INSPECTION
LABORATORY.**

What may be considered an important step toward perfecting our system of inspection and quarantine was taken when our new laboratory was erected on the Oceanic dock. Plants from unfamiliar regions require inspection in a closed room provided with an abundance of light. Frequently also plants need special treatment before being released. To cart such plants to the Government Nursery for the purpose is inconsistent. It became evident therefore that to meet such need a quarantine and inspection laboratory must be erected on the water front. The Oceanic dock was chosen because of the central location. With the consent of the Executive Officer a room about 12x16, 10 feet high, was built beside the fumigatories there. The laboratory has already served its purpose several times with entire satisfaction.



INSPECTION, QUARANTINE AND FUMIGATION LABORATORIES ON OCEANIC WHARF.

**FUMIGATORY
EXHAUST.**

An important improvement in the fumigatory has been installed by the courtesy of Mr. Marston Campbell, Superintendent of Public Works. This consists of a 4-inch gate valve and the necessary piping to serve as an exhaust for the noxious fumes after they have served their purpose. Hitherto these were discharged directly onto the dock with no little danger to operators and at times also to unavoidable bystanders.

PESTS INTERCEPTED IN COURSE OF INSPECTION.

Unfortunately the identification of material was possible in only few cases because of the great rush of inspection and office work, and absence of adequate assistance. But most of the material is on hand in good state of preservation so that identification will be possible in the future.

BUGS (Hemiptera-Homoptera).**MEALY BUGS.**

Pseudococcus spp. on Litchee (China); greenhouse plants (U. S.); (2) plants (Japan); (3 spp.) on plants from W. Indies (?); (*citri*) on Fuchsia from U. S.

COTTONY SCALES.

Pulvinaria sp. on mango (Florida).

TERRAPIN SCALES.

Coccus longulus on orange trees (Cal.).
Saissetia hemisphaerica on orchid.

ARMORED SCALES.

Aspidiotus perniciosus (San Jose scale) on pears and lemons (Cal.).
Aspidiotus rapax (Greedy scale) on pears, apples and lemons (Cal.).
Aulacaspis pentagona (2) plants (Japan); peach trees (Japan).
Chionaspis sp. on mangrove (Manila).
Chrysomphalus aonidum on plants (Florida).
Diaspis boisduvalii on orchids.
Hemichionaspis minor ? on Pomelo (Orient).
Hemichionaspis sp. on coconuts (Fanning Island).
Lepidosaphes beckii on lemons (Cal.).
Parlatoria zizyphi on pomelo (Orient).
Parlatoria sp. on maple (Japan).

WHITE FLIES.

Aleyrodes sp. on *Ceratonia deliqua* (U. S. Cal.); (sp.) on primrose (Cal.); on Christmas berries (Cal.).

PLANT LICE.

Aphis on cabbage (U. S.); on mango (Manila).

MOTHS (Lepidoptera).

Anarsia lineatella in peaches (Cal.).
Carpocapsa pomonella (codlin moth) in apples (Cal.).
 Caterpillars in mangrove stools (Manila).
 Caterpillars in Juniper trees (Japan).
 Caterpillars in garlic (China).

ANTS (Hymenoptera).

Monomorium floricola in orchids (Manila).
 Unknown, in orchids (Brisbane).
Pheidole megacephala in yams (China).

BEETLES (Coleoptera).

Sweet potato borer (*Cylas formicarius*) all stages in sweet potatoes (China).
 Curculionid borer in Dendrobium (Manila).
 Undetermined (Carabid?) roots of forage plant (U. S.).
 Undetermined borers in orchid and their mounting boards (Manila).
 Staphylinid in yams (China).
 Chestnut weevil in chestnuts (Japan).
 Scolytids ? in mangrove stools (Manila).
 Curculionid in mangrove stools (Manila).

MISCELLANEOUS.

Cabbage maggot (*Phorbia brassicae*) in turnips and (?) horse radish (Cal.).
 Egg batch of rear horse (Mantid) on plants (Japan).
 Fruit flies (?) on citrus fruit (Orient).
 Red spider (Acarid) on cut flowers (Cal.).
 Silver fish (Lepismid) on yams (China).
 Rust on peas (Cal.).
 Rust on asparagus (Cal.).
 Potato scab (*Oospora scabae*), potatoes (Cal.).
 Parasitic fungus on yams and sweet potatoes (Orient).
 Soil about lillies and growing plants (Orient and Occident).

LOCAL INSPECTION.

This was confined wholly to visits in private gardens at the request of owners. A Staphylinid beetle was found in numbers apparently damaging ripening figs at Pearl City. Closer examination seemed to show that their presence was due to several over-ripe figs which they inhabited and from which they overflowed to the others. Instruction was therefore given to remove and destroy infested figs and contents. Scale bugs and faulty irrigation were found injurious to fruit and ornamental plants in several gardens. Advice was given accordingly. The thread scale (*Ischnaspis lougirostris*) has been under observation on palms, ilang-ilang (*Canarium odoratum*), etc., for some time. In one instance this pest had brought an ilang-ilang plant to a point where destruction was the only alternative that could be offered. This pest has no effective parasite here and is therefore troublesome on a number of ornamental plants. The "Maui Blight" or, more correctly, Lantana scale (*Orthezia insignis*), has invaded the city of Honolulu in full force, and destruction of a number of valued ornamental plants followed. Lantana on the hillsides also suffered severely, but the extended drought had considerable to do with it.

INTRODUCTION, BREEDING AND DISTRIBUTION OF USEFUL INSECTS.

This line of work was circumscribed this year by the absence of an assistant and by the fact that, after the first shipment of the year of useful insects from Mexico (received in Honolulu, January 27) Mr. Koebele was detailed, by arrangement with the Hawaiian Sugar Planters' and Live Stock Breeders' Associations, for investigation in Europe of enemies of horn fly. These he sent to and were cared for by the Hawaiian Sugar Planters' Association Experiment Station Entomologists. An account of this work is given on page 119.

INTRODUCTIONS. The January shipment above referred to consisted of the ladybirds *Azya luteipes*, Muls., *Chilocorus cacti*, Linn., *Hyperaspis jocosus*, Muls., and a hymenopterous parasite. *A. luteipes* was found a liberal eater of Lecaniid scales, was bred for a while and a number of colonies distributed. The janitor failed to lower the curtain of the insectary one day, and the sun, striking the breeding jars which contained fresh food produced heavy perspiration in the jars which seems to have killed all life in them. One or two larvae have been seen out of doors since and the probability is it will show up in time. *Chilocorus cacti* was bred for a while on the

rose scale (*Aulacaspis rosae*) and the cactus scale (*Diaspis echinocati*). But it made very slow and unpromising progress and finally the colony died out. Only five specimens of *Hyperaspis jocosa* came in larva and pupa state, but all of them were successfully reared to maturity and, as their food is very abundant here, they thrive well and large numbers were distributed in the city and suburbs. We have been able to make no progress whatever with the hymenopterous parasite.

Thru the courtesy of Mr. George Compere, Government Entomologist of West Australia, we were able to release several specimens (male and female) of *Comperiella bifasciata* in May. This insect, Mr. Compere asserts, is an effective enemy of the red scale (*Chrysomphalus aurantii*) in the Orient.

Blastophaga grossorum is the insect that played so conspicuous a rôle in the successful establishment of Smyrna fig culture in California a few years ago. Normally the insect breeds in galls produced within the male fig which is borne on a separate tree (Capritree). As the pollen in these figs is produced simultaneously with the maturity of the insects, these, upon emerging, carry away more or less of the pollen on their bodies. The Smyrna figs which bear the female part of the flower, are also receptive about that time. Failing to distinguish these from the male figs the female flies enter them to oviposit and incidentally fertilize many of the flowers with the pollen on their bodies and thus produce the large number of seeds characteristic of the Smyrna fruit. These seeds, it has been recognized, contain essential oils which give the fruit the peculiar nutty flavor, and make the Smyrna fig such a favorite.

We were aware that the Moanalua Gardens had the requisite Capri and Smyrna trees, but not the insects, without which Smyrna-fig culture is impossible. To bridge the gap the late Mr. Craw communicated with Dr. Geo. Roeding, the moving spirit of the Calimyrna fig industry, and was promised a colony of the insects. On April 7 we received the first colony of these insects. Unfortunately all of them seem to have emerged en route from the figs in which they were sent, and perished—at least we got no satisfactory result. By kindness of Dr. Roeding we received another colony in October but having hardly expected results owing to lateness of season we were not disappointed with failure. However, we are determined to repeat the importation until successful.

**GOOD WORK OF
A RECENTLY NATURALIZED ALLY.**

On page 116 of the Board's Second Report (for 1905) the writer reported the introduction and establishment of the Terrapin scale parasite or Scutellista (*S. cyanea*) in these islands. During the present year it was found so abundant

on the original Coccid host as reported therein and upon the hemisphaerical scale (*Saissetia hemisphaerica*), another occasionally destructive pest, that its great usefulness could not be overlooked. Its new host is also a fact worth recording.

BENEFICIAL INSECT DISTRIBUTION.

This was far larger in numbers of individuals than colonies. In all 63 colonies were distributed, but some of these were composed of hundreds of specimens. Following is the list of insects distributed:

Arizona-dung fly parasite (*Eucoila impatiens*).

Azya luteipes.

"Brownie" ladybird (*Cryptolaemus montrouzieri*).

Chilocorus cacti.

Comperiella bifasciata.

Fig insect (*Blastophaga grossorum*).

Lantana leaf bug (*Teleonemia lantanae*).

Mexican ladybird (*Hyperaspis jocosa*, Muls.).

Vedalia ladybird (*Nozius cardinalis*).

Scutellista cyanea.

GENERAL WORK.

The correspondence of the Division is more heavy in the volume of individual letters than in their number because we make the effort to impress upon correspondents the importance of our work and because, owing to the scarcity of published data on our insect fauna, we are obliged to give full explanation in our letters. We also endeavor to put in writing as far as possible all official acts of the Division.

In all 360 letters were written during the year, principally to local people. Financial records of the Division were kept independently of the Board records, serving the useful purpose of comparison and check. The card index of the inventory is up to date as are indices of accessions to the Entomological library according to author and subject. Eleven monthly reports were made to the Board and were subsequently published in the For-ester. Two lectures on Entomological subjects were delivered before classes of the College of Hawaii and one before a Normal School class. Owing to pressure of inspection work little of a systematic nature was accomplished. General Circular No. 3, embodying Act 69 of Session laws of 1907 and Board rules 3 and 4, regulations on importation of honey and honey bees was issued. The 1907 Report was also published and the supervision of this work consumed an enormous amount of time. This is a

concrete instance where a paid executive officer would be a saving to the scientific staff. Our Bulletin 2 on the subject of Aleo-*didæ* is still in demand among scientists abroad.

RECOMMENDATIONS.

INTER-ISLAND INSPECTION. Evidence is accumulating pointing to the necessity of instituting inter-island inspection.

At one time the Hawaiian Sugar Planters' Association sought our coöperation in preventing the carriage to other islands of a small, cane-top boring beetle known on Oahu only. Several other insects known or suspected to exist in Honolulu and not on the other islands suggest strongly the necessity of some protection for those islands. What should not be lost sight of is that the object of inspection must be to protect the prospective agriculturist as well as the present one. Thus insects infesting citrus plants, for example, are of comparatively little moment now, because the citrus is not yet an economic plant of value to us. But, it is not an impossibility that even citrus may some day play an important role in the economy of these islands and therefore should be afforded *now* all protection of a plant enjoying that distinction. So that it is imperative to maintain pest free as much of the Territory as possible in order to retain the possibility of growing profitably whatever the future might reveal to our advantage.

It seems to us that inter-island inspection is essentially a county business. Counties should protect their respective territories, especially since, because of our geography and the consequent need of an unproportionate number of inspectors, the chances that the Territorial Government will be in a position to undertake the work are remote. County inspection is a regular institution in California and, to our knowledge, valuable and satisfactory. Whatever other officers the counties employ they should have a competent entomological inspector to protect the county against invasion from insect or fungus pests, existing in other counties, and not in their own.

MELON FLY. If we consider the horn fly (*Haematobia ser-rata*) the *most injurious* insect on these islands at present, the melon fly (*Dacus cucurbitae*) easily holds second place. Indeed, if we realize what a boon cucumbers, melons, cantelopes, etc., must have been to every man, woman and child, rich or poor, on these islands prior to the coming of this pest, and how little we have to replace them the conclusion is inevitable that so long as this fly is allowed to play havoc unmolested the people will suffer a restricted variety of their vegetable diet. The habits of the fly are such that it is impossible to check it by ordinary means,—if we consider natural enemies extraordinary.

The fly doubtless reached us by way of China or Japan, tho it is most definitely known to exist in India. Its economic status in the former countries is unknown. But from correspondence with the Imperial Entomologist of India the writer has ascertained that in India it is kept well in check by a variety of parasites and is therefore seldom injurious. In his effort to combat fruit fly (*Ceratitis capitata*) in West Australia the Entomologist of that State after several attempts claims to have finally succeeded in transporting and establishing there several of these parasites. Upon the strength of these facts the Board addressed the Minister of Agriculture of West Australia a request for colonies of these insects. This was the best that could be done under a limited appropriation. But it is barely possible we should get satisfactory results from correspondence alone. The late Mr. Craw always scoffed at these possibilities. He maintained, and we are inclined to agree with him, that nothing short of detailing a competent entomologist to the field for investigation, discovery and shipment of likely parasites will deliver us from this formidable pest. I would respectfully urge therefore upon the Governor and Legislature of this Territory to give this matter their earnest attention and, if at all possible, provide a liberal fund for this work. There is no more crying need in the Territory at present.

**EXECUTIVE
OFFICER.**

An outsider cannot fully realize the immense tax upon the time of the scientific force that is unnecessarily imposed by executive work. Publication, printing, purchases and a host of similar tasks should be carried on by such an officer to greater advantage to the service as a whole. Such duties are on the State Boards of Agriculture performed by their paid secretaries. Some such officer is a dire necessity on this Board. To strengthen the scientific activity of the staff it must be bound down by lay routine as little as possible.

TABLE II.—QUANTITIES AND PRICES * OF FRUITS AND VEGETABLES IMPORTED VIA HONOLULU DURING 1905-1908.

NAME.	@	pr	1905	Value in \$ \$	1906	Value in \$ \$	1907	Value in \$ \$	1908	Value ^e in \$ \$
Apples	1. 50	bx	16636	24954.00	27383	41074.50	19501	29251.50	25185	37777.50
Apricots.....	1. 35	bx	588	793.80	58	78.30	242	326.70	902	1217.70
Artichokes ..	4. 25	bx	.....	.....	.....	.....	238	1011.50	116	493.00
Asparagus...	4. 00	bx	.....	.....	.....	.....	.....	.....	180	720.00
Cabbage	1. 50	crt	904	1356.00	1533	2299.50	1401	2101.50	1456	2184.00
Cantalopes..	2. 25	bx	209	470.25	385	866.25	366	823.50	660	1485.00
Cauliflower.	2. 25	bx	.....	.....	.....	.....	.....	.....	1347	3030.75
Celery	3. 00	bx	.....	.....	.....	.....	.....	.....	633	1899.00
Celery root.	2. 50	bx	.....	.....	.....	.....	.....	.....	14	35.00
Cherries.....	1. 50	bx	310	465.00	299	448.50	410	615.00	588	882.00
Cranberries	13. 00	bb	26	338.00	33	429.00	6	78.00	36	468.00
Garlic	2. 70	bx	400	1080.00	486	1312.20	559	1509.30	436	1177.20
Grape fruit.	3. 75	bx	307	1151.25	327	1226.25	474	1777.50	544	2040.00
Grapes	1. 50	crt	2484	3726.00	3080	4620.00	2580	3870.00	3726	5589.00
Horseradish	1. 50	bx	.....	.....	.....	.....	.....	.....	57	85.50
Lemons	3. 75	bx	2166	8122.50	2348	8805.00	2191	8216.25	2877	10788.75
Nectarines...	1. 25	bx	137	171.25	25	31.25	24	30.00	21	26.25
Onions	2. 50	bx	6774	16935.00	8111	20277.50	7739	19347.50	12186	30465.00
Oranges	3. 00	bx	18637	55911.00	11572	34716.00	20050	60150.00	20507	61521.00
Parsnips.....	. 75	bx	.....	.....	.....	.....	.....	.....	30	22.50
Peas	1. 00	bx	14	14.00	.....	.....	.....	.....	120	120.00
Peaches	1. 25	bx	753	941.25	479	598.75	212	265.00	2646	3307.50
Pears	2. 00	bx	1745	3490.00	878	1756.00	785	1570.00	2973	5946.00
Persimmons	1. 25	bx	120	150.00	274	342.50	397	496.25	394	492.50
Plums	1. 25	crt	2152	2690.00	1872	2340.00	1236	1545.00	2505	3131.25
Potatoes....	2. 00	sk	8446	16892.00	26741	53482.00	32614	65228.00	49842	99684.00
Quinces	1. 25	bx	.....	.....	25	31.25	9	11.25	11	13.75
Rhubarb	1. 25	bx	.....	.....	.....	.....	19	23.75	172	215.00
Sprouts.....	2. 00	bx	.....	.....	.....	.....	.....	.....	54	108.00
Tangerines..	1. 25	bx	533	666.25	2555	3193.75	1227	1533.75	2093	2616.25
Turnips.....	.60	bx	396	237.60	387	232.20	257	154.20	258	154.80
Total, \$ \$			\$ 140,605.15		\$ 178,160.70		\$ 199,935.50		\$ 277,696.20	

* The prices represent closely approximate figures as kindly supplied us by one of the importers.

ACT 69, SESSION LAWS OF 1907.

AN ACT TO AMEND CHAPTER 28 OF THE REVISED LAWS OF HAWAII BY ADDING TO SAID CHAPTER A SECTION TO BE KNOWN AS SECTION 389A.

Be it Enacted by the Legislature of the Territory of Hawaii:

Section 1. Chapter 28 of the Revised Laws of Hawaii is hereby amended by adding a new section thereto to be known as Section 389A and to read as follows:

Section 389A. It shall be the duty of the Board to make rules and regulations, and to amend the same from time to time, in its discretion, subject to the approval of the Governor, for and concerning the importation into the Territory of bees and for the preservation, protection and improvement of bees now within the Territory; and for the quarantine, inspection, fumigation, disinfection, exclusion or destruction either upon importation into the Territory or at any time or place within the Territory of any bees and any box or other container and their contents in which bees have been imported or contained, which is or may be infested with or liable to assist in the transmission or dissemination of any insect or disease injurious to bees. All rules and regulations made as aforesaid shall have the force and effect of law. It shall be the duty of the Board to establish an observational apiary and all bees imported into the Territory shall be there quarantined free of cost to the owners until such time shall have elapsed as to enable the proper entomologist or inspector of the Board, to certify to the owners that such bees are clean and free from disease. The entomologists or inspectors of the Board may enter upon the premises of any bee keeper for the purpose of inspecting apiaries, and of carrying out the orders of the Board, and they shall not be holden guilty of any misdemeanor by so doing nor shall they be personally liable in damages except for acts beyond the scope of their authority or due to their own negligence.

Section 2. This Act shall take effect from and after the date of its approval.

Approved this 17th day of April, A. D. 1907.

G. R. CARTER,
Governor of the Territory of Hawaii.

**RULES AND REGULATIONS PERTAINING TO THE
IMPORTATION AND INSPECTION OF HONEY
BEES AND HONEY INTO THE TERRITORY OF
HAWAII BY THE BOARD OF AGRICULTURE
AND FORESTRY.**

RULE 4. IMPORTATION OF QUEEN BEES.

In order to prevent the introduction into this Territory of infectious, contagious or communicable diseases among honeybees it is hereby ordered that

All queen bees imported into the Territory of Hawaii shall be subject to the following terms and conditions hereinafter set forth, namely:

(1) *Labels.* A label shall be affixed to the cage, box or other container in which any queen bee is enclosed, which label shall set forth:

- (a) The number of queen bees enclosed;
- (b) The locality where each was produced;
- (c) The locality from which each was shipped;
- (d) The name of the shipper;
- (e) The name of the consignee.

(2) *Request for Inspection.* The importer shall file with the Board of Agriculture and Forestry, at least two weeks prior to the date at which the queen bee or bees will arrive, a written statement signed by himself or his agent or attorney which shall set forth his purpose to import said queen bee or bees into the Territory of Hawaii, which statement shall contain as accurately and fully as possible the following information:

- (a) The number of queen bees sought to be imported;
- (b) The probable locality where each was produced;
- (c) The locality from which each is expected to be shipped;
- (d) The name of the proposed shipper;
- (e) The address of the importer, and shipping marks.

Said statement shall also contain a request that the Board, upon arrival of said queen bee or bees, proceed forthwith to inspect or cause to be inspected such queen bee or bees.

(3) *Inspection.* Immediately upon the receipt of such request for inspection or as soon thereafter as may be an inspector of the Board shall inspect each queen bee and if it is found free from such disease shall cause it to be transferred from any cage, box or other container in which it shall have been imported and shall transfer it to a new and clean cage properly supplied with clean and fresh candy and with sufficient bees known to be free from disease to properly care for said queen bee.

(4) *Certificate.* The inspector shall thereupon give to the importer a certificate of his findings upon such inspection and deliver to him such of the bees as he finds free from all infectious, contagious and communicable diseases.

(5) *Destruction of Cages, Bees, etc.* Immediately upon the transfer of any queen bee from any cage, box or other container as set forth in Section 3 hereof, said inspector shall cause to be burned and destroyed such cage, box or other container, together with the candy and bees therein, excepting such queen bee.

If said inspector shall at said inspection find any queen bee to be infected with any contagious, infectious or communicable disease he shall in his discretion destroy the same or hold the same for further treatment.

RULE 5. IMPORTATION OF HONEY.

In order to prevent the introduction into this Territory of infectious, contagious or communicable diseases among honey bees and in view of the fact that such diseases are in the majority of cases communicated by the introduction into uninfected territory, of honey, honey-dew or syrup containing honey from districts in which such infectious, contagious or communicable diseases exist, it is hereby ordered that

All honey, honey-dew or syrup containing honey imported into the Territory of Hawaii, shall be subject to the following terms and conditions, to-wit:

(1) *Statement by Importer.* Any person or persons importing into the Territory of Hawaii any honey, honey-dew or syrup containing honey from the mainland of the United States or elsewhere, upon arrival of such honey, honey-dew or syrup containing honey at a port of entry of the Territory of Hawaii, and before such honey, honey-dew or syrup containing honey shall have been landed upon the dock, or if such honey shall have been landed upon the dock without the

knowledge of the importer, then before such honey, honey-dew or syrup containing honey shall have been removed from the dock, shall file with the Board a written statement containing the following information:

- (a) The port from which such honey was shipped;
- (b) The name of the shipper;
- (c) Whether or not the same has been certified by a qualified inspector as hereinafter set forth.

Said statement shall also contain a request that the Board forthwith proceed to have said honey, honey-dew or syrup containing honey inspected, and an agreement on the part of the importer to be responsible for all reasonable costs and expenses of inspection, quarantine and care of the same.

(2) *Inspection.* Immediately upon the receipt of such statement or as soon thereafter as may be, the Board shall cause said honey, honey-dew or syrup to be inspected by its inspector. In case such honey shall bear upon the containers thereof or shall be accompanied by a certificate or a qualified officer of any state or of the United States or other country, that the honey is from healthy colonies of bees, that is, from colonies of bees not affected with any infectious, contagious or communicable disease, then said honey shall be forthwith passed by said inspector and said inspector shall thereupon furnish to the importer thereof a permit to land the same or to remove the same from the dock as the case may be.

In case such honey shall not bear upon its containers, or shall not be accompanied by a certificate from a duly qualified officer as aforesaid that the same comes from healthy colonies of bees as above set forth, then such inspector shall cause said honey to be removed to some place there to undergo such tests as the Board shall from time to time prescribe to determine whether or not said honey, honey-dew or syrup containing honey is infected with any infectious, contagious or communicable disease. Upon the completion of such test said inspector shall certify his findings. If said honey shall be found free from any diseases as above set forth said inspector shall so certify and shall thereupon deliver such honey, honey-dew or syrup containing honey to the said importer. If, however, such honey shall be found infected with any infectious, contagious or communicable disease, the inspector shall forthwith notify the importer of such fact and such importer shall have a reasonable time thereafter to return or export said honey to some port without the Territory of Hawaii. But should said importer refuse to return or export said honey, or

neglect so to do within a reasonable time, then said honey shall be destroyed in such manner as shall be determined by the Board.

These rules and regulations were approved at a meeting of the Board of Commissioners of Agriculture and Forestry, held on September 2nd, 1908.

(S) C. S. HOLLOWAY,
President and Executive Officer,
Board of Agriculture and Forestry.

Approved:

(S) W. F. FREAR,
Governor.

September 17, 1908.

PROF. KOEBELE'S WORK ON HORN-FLY.*

On April 9th, 1908, I wrote Mr. Koebele final instructions as to leaving for Europe in search of horn-fly parasites, and other natural enemies of that pest. Owing to various circumstances it was not till considerably later that he was able to leave New York for Germany. I had requested him, if possible, to call on Dr. Howard, the chief of the Division of Entomology, at Washington, as I had understood that that Division might be doing work of the same nature in Europe, as we were about to attempt. Mr. Koebele was unable to see Dr. Howard personally, but, after correspondence, informed me that work on the horn-fly on these lines would not be undertaken by the entomologists of the Washington Department.

During the summer months Mr. Koebele's time was entirely occupied in making observations in the field, and breeding flies, together with some parasites and predaceous insects from larvae found in cow-dung.

In July he wrote briefly of his observations, and especially mentioned the importance of Hister beetles and their larvae in devouring the larvae of flies that breed in dung, and also the scarcity of parasites, as compared with predaceous insects, at that season.

* The following preliminary report was furnished by Dr. Perkins at the request of the Board and the Hawaiian Live Stock Breeders' Association.

Before proceeding further it may be said that there are two methods of diminishing the numbers of dung-eating flies, (1) the direct method, by the introduction of parasites and predaceous enemies, (2) indirect, by the introduction of harmless dung-eating insects, which quickly remove the dung and so leave less food for the injurious flies to breed in. Somewhat intermediate between these classes is a third lot of harmless species, which, while they live in the dung, do not consume it or remove it rapidly enough to prevent the breeding of the obnoxious flies, but, at the same time, they perforate the cow droppings with passages in every direction, and allow the parasites of the flies to more readily approach and attack these. This class is already represented by several species here in the islands, and Mr. Koebele sent over larvae of a larger and more robust species, than any that we have here. At first I doubted the advisability of liberating these, not because they could possibly do any injury to vegetation, but because they will probably form part of the food supply of the voracious Histers, which may partly turn their attention to these, and therefore destroy a smaller percentage of fly maggots.

Mr. Koebele's method of sending specimens, so far adopted, has been to place the living insects with food in glass tubes of various sizes; these tubes are wrapped in cotton and enclosed in tight-fitting cylindrical wooden boxes. They are thus forwarded by mail to Mr. Ehrhorn, the inspector at the port of San Francisco. Thence to the islands they are sent in cold storage. This method of sending has proven so satisfactory that nothing more need be desired. It is only possible during the cold part of the year, but that is all the better, as it will leave Mr. Koebele free to make his observations and gather material during the summer, to be forwarded here in the winter, which is the most favorable time for establishing the European insects. In all, I have received up to date thirty-nine vials from Mr. Koebele, containing sometimes a single insect in a vial, sometimes two or three, in the case of predators; in some have been sent numerous puparia of flies in the hope of breeding parasites.

Vial 1 contained some living larvae of a dung-beetle (*Aphodius*). Mr. Koebele was of opinion that this species was very desirable, but, partly owing to local conditions, which probably he had not in mind, and partly because the insect belongs to that intermediate class mentioned above, I should not place so high a value on its services, if established. It is likely to thrive best, and to be most useful in wetter districts or in drier ones at a considerable elevation above the sea level. From these larvae sent over, I later on had the satisfaction of breeding a small colony, which were sent to windward Hawaii, and liberated in a place,

where further colonies could be easily obtained later, if they are successfully established, as they probably will be.

Vials 2-8 contained puparia of various dung-eating flies. From these I bred numerous species of a parasite, *Spalangia*, which I cannot separate from one already here, and which has been known here for at least thirty years. I am, however, making further observations on these, as I have received a nearly identical parasite from China, through our Assistant Entomologist, Mr. Terry, and a third also excessively similar is known to me from Mexico.

Vials 9-12 contained similar parasites.

Vials 13-15 contained predaceous beetles (Hister and Saprinus) hybernating, one in each tube. It is very important to introduce these and similar species, and, but for certain special local difficulties, this would be easy enough.

Vials 16-20 contained larvae of a beetle eating up the larvae and puparia of flies in dung. Mr. Koebele suggests that this will produce a Tenebrionid beetle and this is certainly correct, though the larvae, of which three arrived alive, have not yet matured.

Vials 20-24 puparia of flies likely to produce parasites.

Two species of parasites were bred from these belonging to the Alysidae and the Ichneumonidae. Of the latter no pairing was obtained, but from the former, of which two females and one male emerged at intervals, a brood may be obtained. Both these and other allied parasites in numbers ought to be introduced here, especially as they not only destroy fly larvae in dung, but also those found in dead carcasses, from which, especially, are produced the flies that cause maggots in sheep. The chief hindrance to the establishing of these parasites would seem to me to be the general absence of such flowers on the ranches, as the mature insects visit for the purpose of feeding, and especially of those white-flowered umbelliferous plants, which are found in every field, hillside and pasture in Europe, and attract these parasites in extraordinary numbers.

Vial 25. Larva of *Philonthus*, considered by Mr. Koebele one of the best enemies for horn-fly. This vial, however, contained a larva of a Hister beetle on arrival, so that either an error was made, or the latter devoured the former in transit.

Vial 26-28. *Staphylinus pubescens*, a predaceous beetle, likely to devour the dung-beetles, as well as the injurious flies. These arrived dead, so the species could not be experimented with.

Vials 29-30. *Philonthus aeneus*, three or four mature specimens arrived in fine condition. As mentioned above (Vial 25) Mr. Koebele considers a number of species of this genus are wanted, being very important.

Vials 31-34. Contents mostly dead and of not much importance.

Vials 33-35. Three or four mature Hister beetles received alive recently.

During the coming summer I have suggested to Mr. Koebele that he should get together a lot of material of the above insects, most likely to be successful, and ship them, as soon as the cold weather sets in in America and Europe. He should then visit Northern Africa probably, and the more southern parts of Europe for other kinds of enemies of horn-fly. Certain local conditions here are of paramount importance and must be fully considered in estimating the value of the natural enemies of dung-flies in Europe, and selection of these enemies must be made to suit these conditions or no success will be attained. This is a complicated subject and cannot be entered into in this report; in fact, my observations on the matter, though I have recently given much time to it, are still far from complete.

There has recently been a great deal of talk about the introduction of birds into the islands, and some by no means well advised suggestions have been made in this direction. If birds are to be introduced at all, I know of none more likely to be of great value than a common black and white Australian fly-catcher related to the little native 'Elepaio.' I referred to this bird in the Proceedings of the Hawaiian Entomological Society, Vol. 1, p. 10, as follows: "Another species (of fly-catcher) is commonly seen catching flies off the backs of cattle. It would be most valuable in these islands." An ornithologist, (whose name I forget) connected, I think, with the Museum at Brisbane, informed me that it would be possible to introduce this bird. I myself had daily evidence of its great value.

With regard to Mr. Koebele's work, it will, no doubt, be necessary for this office to make a complete report, when that is possible, either for publication by this Station or by the Territorial Board of Agriculture and Forestry.

We are indebted to Mr. Edward M. Ehrhorn, Entomological Inspector of the State Board of Horticulture of California, at San Francisco, for receiving and forwarding to us the material sent by Mr. Koebele, and to Mr. Kotinsky for promptly delivering the same to us on the arrival of the steamers in Honolulu.

Yours very truly,

R. C. L. PERKINS.

DIVISION OF ANIMAL INDUSTRY.

Report for the Year Ending Dec. 31st, 1908.

BY VICTOR A. NORGAARD V. S. (Copenhagen).

Superintendent of Animal Industry, Board of Agriculture and Forestry, Territory of Hawaii.

Veterinary Inspector U. S. Bureau of Animal Industry.

LETTER OF SUBMITTAL.

The Board of Commissioners of Agriculture and Forestry,
Honolulu, Territory of Hawaii.

Gentlemen:—

I have the honor to submit herewith my fourth annual report as Territorial Veterinarian, covering the work of the Division of Animal Industry for the calendar year of 1908.

The force of the Division has during the year been increased by the appointment of two Deputy Territorial Veterinarians, one for the district of Hilo, and one for the district of Maui. Their appointments were only effected through the coöperation of the local Sugar Planters' Association and various agricultural and live stock interests, which by taxing themselves at a pro rata scale provided a salary of \$100 per month for each of the two deputies. The value of this service has been fully demonstrated during the period in which it has been in effect, and it is hoped that the coming legislature will see its way clear to provide funds for the salary of the two deputies above mentioned as well as for two more, one to look after Kohala and Hamakua and one to be stationed on Kauai. Such an arrangement would open all of the ports of entry of the Territory to the importation of live stock and would place the other islands on the same basis as Oahu as far as the eradication of infectious and contagious diseases among live stock is concerned.

The new regulations governing the importation of live stock, and which were published in the report for last year, went into

effect on the 1st of January, 1908. These regulations which made the inspection and testing of live stock compulsory before shipment to this Territory, and which places this inspection and testing in the hands of the inspectors of the federal Bureau of Animal Industry, have proven highly satisfactory. That glanders nevertheless, in one instance, gained entrance to the Territory with inspected and tested stock was not due to any defect in the regulations or their enforcement, but to the unfortunate live stock sanitary condition of California. The incident in question, which is fully discussed in this report, necessitated the promulgation of a new regulation imposing a quarantine of three weeks from the date of shipment on all horse stock arriving in the Territory from or through California. This regulation will continue in effect until conditions in California warrant its abrogation.

In regard to diseases among live stock a considerable number of outbreaks of glanders have occurred on both Oahu, Maui and Hawaii.

On Hawaii a widespread epidemic of a catarrhal disease has prevailed among the horses on many plantations and ranches and has caused considerable loss. This disease is fully described in the appended report of the Deputy Territorial Veterinarian for the Hilo district.

Otherwise the general health of the live stock has been good, except so far as affected by the prolonged drouth, which has caused greater losses than ever known before.

I have as far as possible omitted the discussion of technical papers in this year's report, as the greater part of my report for 1907 was given over to this subject.

Very respectfully,

VICTOR A. NÖRGAARD,
Territorial Veterinarian.

LIVE STOCK INSPECTION SERVICE.

With the beginning of the past year the new regulations requiring the inspection and testing of horse stock and cattle before shipment to this Territory went into effect. These regulations were published in the preceding report of this Division and it is therefore not necessary at present to discuss them except so far as their effectiveness has been demonstrated through the experiences of the past year.

It will be remembered that these new regulations, with the consent of the Chief of the United States Bureau of Animal Industry placed the entire responsibility for the inspection and testing of live stock intended for shipment to this Territory in the hands of the officers of the said Bureau, thereby obviating the necessity for official or semi-official inspectors appointed by this Board. The fact that the State of California, and especially the City of San Francisco, is infested with glanders to a degree almost if not entirely epidemic, has been brought home to this Board repeatedly. The further fact that no efforts of any kind were being made by the state or municipal authorities to suppress or eradicate the disease or even to prevent the infection of stock intended for export to this Territory led us to apply to the Federal authorities for protection. But notwithstanding this most efficient service, which we obtained, it was found that there were still loopholes where tested stock could become infected before they got away from the shores of California. On May 28th, 1908, the American-Hawaiian S. S. "Virginian" arrived in Honolulu with eight mules on board, consigned to H. Hackfeld & Company and destined for a plantation on Kauai. This shipment was infected with glanders, even though it did not become manifest until a few days after arrival.

The following official correspondence pertaining to this subject will illustrate more fully than could otherwise be done the seriousness with which this last importation of infected stock from California was viewed by the Board of Agriculture and its officers, as well as by the business interests of the Territory:

(The Territorial Veterinarian, Honolulu, to the U. S. Inspector in Charge, San Francisco.)

Honolulu, May 28, 1908.

The S. S. "Virginian" arrived here yesterday with eight mules consigned to H. Hackfeld & Co., Honolulu.

I notice from the accompanying papers that 12 mules were tested and that 4 were rejected on account of reaction to the test. The mules came from the ranch of Miller & Lux and were tested at Los Banos by Dr. A. W. Ward.

In this connection I beg to call your attention to a shipment of 34 mules which arrived at Hilo, Hawaii, on the S. S. "Enterprise" on April 13th. These mules also came from the ranch of Miller & Lux and four out of the 38 tested had been rejected on account of typical reaction. For this reason I had the 34 mules which were shipped placed in provisional quarantine on the respective plantations to which they were consigned, for one month.

For the same reason I have detained the eight mules which arrived here yesterday and which are intended for a plantation on Kauai, for the purpose of keeping them under observation for at least one week before they go to their ultimate destination.

I would like to ask you whether you have any information in regard to the prevalence or otherwise of glanders on the ranch of Miller & Lux and if there is any way in which you could ascertain whether any of the reacting mules have developed glanders since they were tested. If you have information on this subject, will you be good enough to advise me as to whether it would not be advisable to avoid the shipment of mules from the ranch in question, as a careful examination of the temperature charts forwarded by you shows that the eight rejected mules had typical temperature curves such as we would expect from infected animals.

(The U. S. Inspector in Charge, San Francisco, to the Territorial Veterinarian, Honolulu.)

San Francisco, Calif., June 8, 1908.

I beg to acknowledge receipt of your favor of May 28th regarding shipment of mules on the steamer "Virginian," consigned to H. Hackfeld & Co., Honolulu, and also a shipment of mules via the S. S. "Enterprise" to Hilo, all of which came from the ranch of Miller & Lux, at which a number of those tested were rejected. I beg to say that I am taking steps to ascertain, if possible, the condition of the rejected mules at the present time, and also as to the presence of clinical glanders on this ranch.

As soon as I secure this information I will advise you.

(The Territorial Veterinarian, Honolulu, to the U. S. Inspector in charge, San Francisco.)

Honolulu, June 13, 1908.

Referring to my letter of the 28th ult. I regret to inform you that one of the eight mules which arrived here on the S. S. "Virginian" on May 27th and consigned to H. Hackfeld & Co., developed acute glanders and was destroyed in a dying condition on the 9th inst.

As I stated in my letter above referred to, these eight mules were intended for the Grove Farm Plantation Company on the Island of Kauai and were to be shipped to that island the day after their arrival here, but owing to the fact that the test records showed that these mules had been tested together with four other mules which gave typical reaction, I decided to detain them in Honolulu for a week for the purpose of observation. This action on my part was also due to the fact that nearly all of the animals had a slight discharge from the nose, such as is frequently seen in animals arriving here, and in one case this discharge was slightly sticky. Outside of this no actual symptoms of glanders could be discovered.

The eight mules were placed in a private pasture and were inspected every day. The discharge soon disappeared from all of the animals and their noses looked apparently clean up to June 2d when I had them all tied up for a more careful examination. I noticed then that one of the mules had sticky brownish crusts around both nostrils and that his sub-maxillary

glands had become slightly enlarged and were somewhat tender. The animal also seemed depressed and had a temperature of 103° F. I then had him removed to the animal quarantine station and the following day minute pustules appeared on the nasal mucous membrane. From then on the case developed rapidly. The temperature rose to 104° F. making the mallein test unavailable. I therefore inoculated a male guinea pig intra-abdominally with a suspension of the nasal discharge. This was on June 5th when the mule's temperature had risen to 104.4° F. On June 8th the guinea pig developed typical orchitis thereby demonstrating beyond a doubt that the mule was suffering from glanders.

At the request of the chairman of the Committee on Animal Industry the consignees of the mules, that is, H. Hackfeld & Co., engaged Dr. A. R. Rowat, a practicing veterinarian of this city, to look after the sick mule for them. Dr. Rowat fully agreed with me and my assistant, Dr. J. C. Fitzgerald, that the animal was suffering from glanders.

On Monday the 8th the chairman of the Committee on Animal Industry together with the consignee of the mules besides Dr. Rowat, my assistant and myself visited the quarantine station and found the sick animal with profuse discharge from both nostrils, extensive ulcerations on both sides of the septum, large painful swelling of the sub-maxillary glands, temperature 104.8° F., respiration snorting and the nasal passages almost obstructed by the extensive swelling of the mucous membrane. Farcy strings and buds had appeared on the left side of the face and neck. With the consent of everybody concerned the mule was destroyed on the 9th inst. and was found on post mortem examination to suffer from acute glanders.

The septum will be forwarded to you together with an affidavit to the effect that the same is the septum of the mule herein referred to. This specimen should be held at the disposal of H. Hackfeld & Co., San Francisco, in case litigation should ensue.

I shall not try to explain to you the sensation which this case caused here, but I can assure you that it was very fortunate for me and for the whole inspection service that this shipment of mules were detained and not allowed to proceed to Kauai as desired by the consignees. There has been no glanders on the island of Kauai for years and as no veterinarian is located on that island, it is highly probable that a number of animals might have become infected with glanders before notice of the condition of the animal could have been forwarded to Honolulu and a veterinarian sent to Kauai for investigation.

This makes the fourth time since I took charge of the inspection that glanders has come in here with mules from California, the animals in two cases having been mallein tested before leaving the Coast.

From your former letters I am acquainted with the conditions which you have to deal with in California and I trust that you will feel assured that our Board appreciates everything you have done to help us and that we realize that this last case is due to circumstances over which you have no control.

I have written you fully on the subject in order to enable you to suggest steps to be taken to prevent further occurrences of this nature.

The live stock sanitary conditions in California are undoubtedly in a deplorable state and I am, therefore, anxious to hear from you in regard to any suggestions which you may be able to make for the protection of our live stock industry in the islands. We must have mules and we are practically compelled to get them from or through California.

As quite a large number of California mules are expected here in the near future I take the liberty to ask you once more to do whatever is possible to prevent their exposure to infection during or after the test and while awaiting shipment.

To prohibit the shipment of an entire consignment of mules on account

of one or two doubtful reactions does not seem advisable, but action must in my opinion be left entirely to the discretion of the inspector making the test. When a large percentage of a bunch reacts to the test, as was the case with this last shipment, it would seem well to inquire into the possible cause for such reactions before permitting shipment.

(The U. S. Inspector in Charge, San Francisco, to the Territorial Veterinarian, Honolulu.)

San Francisco, Cal., June 22, 1908.

I am just in receipt of your favor of June 13th describing the conditions of the 8 mules arriving there on the S. S. "Virginian" on May 27th, consigned to H. Hackfeld & Co., and which were destroyed for acute glanders. As I have already written you, these came from Miller & Lux's Los Banos ranch and on receipt of your last letter I wrote Miller & Lux notifying them that, owing to the large number of rejections among mules from this ranch I would decline to make any more tests from there.

I also wrote the State Veterinarian advising him fully of the conditions and asking him for definite information as to that entire vicinity. Up to date I have no reply from him.

Now in regard to suggestions to prevent a repetition; I think it would be wise if the Governor of the Territory could appeal to Governor Gillett of California to take some active steps against glanders in the state. *We are full of it here and everybody recognizes it and everybody knows it.* I am writing to the Secretary of Agriculture thru the Chief of the Bureau and suggesting to him that he also appeal to the state authorities to inaugurate a campaign against the disease.

I have endeavored to be very particular in the selection of the men to make the tests and believe that every single test that I have approved has been properly and carefully and conscientiously made.

I have requests from dozens of veterinarians to allow them to make official tests, which I refuse on the ground that I do not know the men and am not always able to visit the corrals when the tests are being made and so would have no control of the tests whatever. I have caused a good deal of hard feeling in the profession locally on this account, but this cannot be helped.

The remaining seven mules were continued in quarantine until June 23d, when they were allowed to proceed to their ultimate destination, after having been submitted to the mallien test.

On the same day a meeting was called by the chairman of the Committee on Animal Industry for the purpose of considering action to be taken by this Board for the further protection of the live stock industry of the Territory against the introduction of infectious and contagious diseases with shipments of live stock from California. The meeting was held in Mr. Isenberg's office and was attended by Mr. D. P. R. Isenberg, chairman; Mr. Geo. R. Carter and Mr. Albert Waterhouse, members, and the Territorial Veterinarian. The meeting was called to order by Mr. Isenberg at 9 o'clock A. M.

At the request of the chairman Dr. Nörsgaard made a statement in full in regard to the infected shipment of mules as it has already been described. The fact that a serious

outbreak of glanders on the Island of K auai, where the disease has not been known to exist for the past fifteen years was narrowly avoided, was discussed in full. Mr. Carter stated that the situation was of such importance that he would consider it advisable to submit the matter for the consideration of the local agents of the sugar planters and made a motion to the effect that a meeting of the committee be called for 3 o'clock of the same afternoon and that representatives of all the principal importers of horse stock be invited to attend the same. The motion carried and the chairman appointed Mr. Carter and Mr. Waterhouse a committee to call on the said importers and invite their attendance.

At 3 o'clock the second meeting of the Committee on Animal Industry was called to order by the chairman in the room of the Chamber of Commerce, Stangenwald Building. There were present Mr. D. P. R. Isenberg, chairman; Messrs. Geo. R. Carter and Albert Waterhouse, members, and the Territorial Veterinarian. The following firms and corporations were also represented: C. Brewer & Co., Alexander & Baldwin, Schaefer & Co., H. Hackfeld & Co., T. H. Davies & Co., and the Hawaiian Live Stock Breeders' Association.

The chairman explained the purpose of the meeting, recalling the fact that the Board of Agriculture and Forestry, through its Committee on Animal Industry, had inaugurated and perfected the inspection of live stock intended for importation to this Territory, obtained the assistance and co operation of the Federal Bureau of Animal Industry; that all horse stock was tested and inspected by federal officials before shipment from California, and that the most careful inspection was made of all live stock upon arrival to this Territory. That the Board felt that it had practically reached the limit of its efforts for the protection of the live stock of the Territory without imposing onerous restrictions or promulgating regulations which would make the importation of live stock, if not impossible, at least difficult and expensive. But in spite of all efforts glanders has again made its appearance among imported mules after their arrival in the Territory, the circumstances demonstrating without doubt that the shipment referred to was infected before leaving San Francisco.

The chairman's remarks were supplemented by Mr. Carter who submitted for the consideration of the representatives of the sugar planters and live stock owners the necessity for taking decisive steps for the protection of the live stock in the Territory. At the request of the chairman, the Territorial Veterinarian gave such information as was in his possession regarding the live stock sanitary conditions of California, the prevalence of glanders in the said State and the failure of the local authorities to take ef-

fective measures for the suppression and eradication of this disease.

The question of a prohibitive quarantine against all horse stock from the State of California was submitted by Mr. Geo. Carter for the consideration of the meeting. Mr. Carter was of the opinion that the required number of mules for the Territory could be obtained from the central mule-breeding states and shipped to this Territory via Seattle or else shipped in quarantine through California and San Francisco to the Territory. Dr. Nörsgaard explained that this would require further coöperation on the part of the Federal authorities, involving the establishment of quarantine pens for the detention of the animals while awaiting shipment to the Territory.

Mr. E. Wodehouse, representing T. H. Davies & Co., suggested a restricted quarantine of all horse stock after arrival here, but was not in favor of prohibiting the importation of horse stock from California.

Dr. Nörsgaard was called upon to explain how long it would be necessary to keep animals in quarantine after arrival here to make reasonably sure that the animals would be free from infection upon their release. He explained that in his opinion a period of three weeks from the date of shipment would in 99 per cent. of all cases be a sufficient guarantee for the health of the animals, at least as far as mules were concerned, if no suspicious symptoms had developed during that period. This would in all cases where animals arrive here by steamer, necessitate their detention for about two weeks while the quarantine period would be considerably shorter in the case of animals shipped by sailing vessels. The measure would further necessitate the enlargement of the animal quarantine station in Kalihi, as well as the establishment of quarantine stations at Hilo and Kahului. As the Island of Kauai had taken no steps for the appointment of a Deputy Territorial Veterinarian all animals intended for shipment to that island would have to be dealt with as hitherto by the Honolulu authorities.

At the motion of the chairman the meeting adjourned leaving it to the Board of Agriculture and Forestry to take the necessary steps to carry out the measures agreed upon.

The first move in this direction is contained in the following letters:

(The President of the Board of Agriculture and Forestry to the Governor of Hawaii.)

Honolulu, Hawaii, July 2, 1908.

By direction of the Commissioners of Agriculture and Forestry, I beg to call your attention to the condition prevailing here in regard to the

importation of live stock, especially horses and mules, from California to the Territory of Hawaii.

In a number of cases the infectious and contagious disease of glanders, dangerous to man as well as to the horse-stock of this Territory, has been introduced here with animals brought from the State of California.

We have, as far as possible, taken every precaution to protect these islands against the introduction of this disease, but we find that even though we have the efficient coöperation of the officials of the federal Bureau of Animal Industry of the Department of Agriculture it is still possible for cases of glanders to be introduced here.

From careful and, what we believe, unprejudiced investigation of this state of affairs we are forced to the conclusion that the excellent laws of California governing live stock sanitary measures are not enforced to the degree requisite for the protection of this Territory, in the case of importations from that State.

The Commissioners are reliably informed that glanders prevails among the horse-stock of California to an extent which makes it dangerous for this Territory to draw its supply of horses and mules from that State, even though it may seem difficult for us to obtain these animals from elsewhere, without considerable additional expense.

We have, as stated, secured the coöperation of the Federal Authorities, and all horses and mules intended for shipment to this Territory are inspected and tested with every possible care; nevertheless glanders, the most destructive of equine diseases, continues to make its appearance here with stock brought in from California.

The Commissioners desire to call your attention to this matter and would respectfully request, that you communicate with the Governor of California in order that he may be fully informed as to existing conditions, and we sincerely trust that he will be able to suggest remedies in the line of a strong campaign against glanders in that State.

The Territory of Hawaii has about \$2,000,000 invested in imported horse-stock, principally mules, a large majority of which have been purchased in California. The demand for mules is steadily increasing and for economic reasons importers here feel compelled to obtain their supply from that State. Otherwise a motion recommending the prohibition of the importation of horse stock from California would have carried at a meeting of the agents of the principal sugar plantation and ranch companies, held in Honolulu during the past week.

At this meeting those present were informed that the Board of Agriculture and Forestry intended to make a regulation that hereafter all horses and mules imported from California would be subjected to a quarantine at port of arrival here for a period of twenty-one days after date of shipment and this precautionary measure was heartily approved.

Such regulation, of course, would be subject to your approval before taking effect, but we sincerely trust that you will see the importance of such action by this Board.

It would seem to the Commissioners that the Governor of California being apprised of the facts would be very glad to issue the necessary instructions to the proper officials in order to protect the reputation of that State as far as the live stock industry is concerned.

(The Governor of Hawaii to the President of the Board of Agriculture and Forestry.)

Honolulu, Hawaii, July 3, 1908.

I have to acknowledge the receipt of your letter of the 2nd instant and to state that I have written to the Governor of California upon the subject as requested by you, also enclosing to him a copy of your letter to me.

Owing to the limited quarantine facilities at Honolulu and the total absence of the same at any of the other ports of entry the Committee on Animal Industry found itself severely handicapped in formulating a regulation to meet the exigencies under consideration. At a meeting of the said committee on July 15th the question as to whether the quarantine should be enforced at the port of entry or whether importers should be allowed to take their animals to premises provided by them at a distance from the port of entry was fully discussed. The committee decided that as soon as the Board was able to provide quarantine premises at the ports of Honolulu, Hilo and Kahului, all horse stock from California must be quarantined at the Board's premises unless the owner, importer or consignee is able to provide suitable premises at or near the said ports of entry.

As finally adopted by the Board in regular session the following rule was approved by the Governor and went into effect on July 31st, 1908:

RULE 8—QUARANTINE OF HORSE STOCK (HORSES,
MULES AND ASSES) ARRIVING FROM OR
THROUGH THE STATE OF CALIFORNIA.

Owing to the fact that glanders has again made its appearance among mules arriving here from California, and to the further fact that the Board of Commissioners of Agriculture and Forestry has definite information to the effect that glanders prevails in the State of California to an extent which makes it unsafe to rely on the present regulations governing the importation of live stock to this Territory, it is hereby ordered that:

Until further notice all horse stock (horses, mules and asses) arriving in this Territory, from or through the State of California, shall be quarantined, at the port of entry, for twenty-one days, counting from the date of departure from California.

By quarantine shall be understood the absolute segregation of such animals, so as to preclude the possibility of glanders infection being transmitted to other horse stock.

If the owner, consignee or importer so desires, and if he is able to provide premises, which in the opinion of the Territorial Veterinarian or his deputy are suitable and convenient for the purpose, such horse stock shall be quarantined on the premises provided by the said owner, consignee or importer. Otherwise they shall be taken in charge by the Territorial Veterinarian or his deputy and quarantined on premises provided by this Board or by its officers.

If at the end of the stipulated period the Territorial Veterinarian or his deputy is not satisfied that the animals are free from

glanders or other contagious diseases, the same shall be either subjected to the mallein test or continued in quarantine, or both, until released and admitted to the Territory.

All expenses in connection with the quarantining of horse stock as above specified shall be borne by the owner, importer or consignee.

While this rule remains in force the ports of Honolulu, Hilo and Kahului shall constitute the only ports of entry for horse stock (including mules and asses) coming from or through the State of California.

All rules pertaining to the importation of live stock, as well as to the inspection and testing of live stock intended for importation, shall remain in force, except so far as they may conflict with this rule.

This rule shall take effect from and after the date of its approval.

C. S. HOLLOWAY,

President and Executive Officer, Board of Commissioners of
Agriculture and Forestry.

Approved July 31, 1908.

WALTER F. FREAR,
Governor.

NOTE:—Any violation of this regulation is a misdemeanor and punishable by a fine not to exceed \$500 (See Sec. 390, Chapter 28, Revised Laws, 1905, and amendment thereto, Sec. 3, Act 28, Session Laws, 1905, and Act 112, Session Laws of 1907).

APPROVAL AND ASSISTANCE OF FEDERAL AUTHORITIES.

That this action taken by the Territorial Board of Agriculture was approved by the federal Bureau of Animal Industry will be seen from the following letter. That the said Bureau also rendered every assistance possible in the eradication of glanders in the State of California, by supplying mallein and by lending the services of its officers is also manifest.

(The Chief of the Bureau of Animal Industry, U. S. Department of Agriculture, Washington, D. C., to the Territorial Veterinarian, Honolulu, Hawaii.)

Washington, D. C., August 24, 1908.

Referring to your letter of the 13th ultimo, with enclosures relative to the action of the Hawaiian Territorial Government, resulting from the

appearance of glanders among mules shipped from California after they had failed to react to the mallein test, its action in placing a 21 days' quarantine on all horse stock coming from or through California, although unfortunate for the live stock exports of that State, is, however, apparently the only safe course which it could have pursued in order to prevent the possible importation of glandered animals.

This matter of glandered stock in California was also called to the attention of Dr. Charles Keane, State Veterinarian, by this Bureau. Dr. Keane states that he is instituting a campaign for the suppression of glanders in that State as far as the amount of money appropriated will permit. For the Miller & Lux ranch, from which the animals originated which developed glanders after landing in Hawaii, Dr. Keane has secured one thousand doses of Bureau mallein to test their animals.

Dr. Geo. S. Baker, Inspector in Charge, San Francisco, and Dr. A. E. Rishel, Inspector in Charge, Los Angeles, have been requested to render Dr. Keane all possible assistance.

QUARANTINE STATIONS.

The next question to be considered was the establishment of an animal quarantine station at Hilo and Kahului and the construction of a new detention or observation station at Honolulu.

The old quarantine station in Kalihi could not at all times be considered a safe place for the detention of imported animals as diseased or suspected horses were frequently kept there and a large number of glandered horse stock were taken there for destruction and burial. This station is furthermore in so dilapidated a condition that it cannot be considered safe to keep both healthy and diseased animals there at the same time even though the various pens are separated by wide alley-ways.

The Committee on Animal Industry, therefore, recommended the establishment of a new quarantine station and a suitable site was found on the corner of the Beach road and Ward avenue just Ewa of the Union Feed Company's stables. Besides the stables just mentioned there are no buildings or dwellings in this locality and the Board obtained the lease on the lot in question for \$15 per month. The lot which contains about one acre was provided with a good outside fence, inside of which were built two enclosures, each 80 feet by 100 feet and separated from each other as well as from the outside fence by at least a distance of 20 feet at all points.

Each enclosure was provided with shelter for about 20 animals as well as with mangers, hay-racks and watering troughs.

The total cost of these improvements amount to about \$400.

As far as Hilo is concerned the matter of selecting a suitable site was referred to the Deputy Territorial Veterinarian at that port. The deputy reported on a number of sites which might be had for the purposes in question and in August the chairman of the Committee on Animal Industry and the Territorial Veterinarian inspected these sites in person, but found later that the

one selected by them and which was located on land belonging to the Territory could not be obtained for the purpose in question as public sentiment was against it.

Upon the advise of Dr. Elliot, the Deputy Territorial Veterinarian, a piece of land was then rented from the Hilo Sugar Company. This is situated on the Piilhonua tract, and has an area of about two acres and was chosen because it offered the combined advantages of a reasonable rent, permanency of tenure, convenient water supply and proper facilities for isolation. The property is enclosed with stone walls and fences, inside of which has been built a substantial wire fence 15 feet from the outer wall and which divides the area into two separate paddocks. Each of these paddocks is provided with drinking troughs for the animals and with sheds capable of accommodating about 15 animals each.

Further improvements in these sheds so as to offer more complete protection against the weather will be needed and their capacity should be enlarged.

An additional small stable in which animals showing suspicious symptoms of contagious disease can be separated and kept under observation is also necessary.

In regard to the establishment of a quarantine station at Kahului the Committee on Animal Industry decided that in view of the fact that no funds were available for this purpose and that all horse stock intended for Maui arrive in Honolulu first it would be better not to attempt to establish a quarantine station on Maui at the time being, but to hold horse stock intended for Maui in Honolulu through the required quarantine period. It is, however, highly desirable that a quarantine station should be established in Kahului and the next legislature will be petitioned to provide funds not alone for the establishment of such a station for the district of Maui, but also for a similar station for the Island of Kauai and for the enlargement of the present station at Hilo. The old quarantine station in Honolulu will also have to be entirely rebuilt and it is hoped that sufficient funds will be provided for this purpose.

RESULTS FROM INSPECTION SERVICE.

As already stated all horse stock and cattle must before shipment to this Territory be submitted to respectively the mallein or the tuberculin test to insure against their being affected with either glanders or tuberculosis. During the past year the Federal officers under whose supervision all tests were made rejected the following number of animals as reacting to the respective tests:

Class of Animals.	Number Tested.	Number Rejected.	Percentage.
Horses	157 (mallein)	4	2.55
Mules	730 (mallein)	35	4.79
Cattle	93 (tuberculin)	18	19.35

While it cannot be claimed with certainty that all of the 39 horses and mules which reacted to the mallein test were affected with glanders at the time of the test, still a careful examination of the test records shows, in a majority of cases, such typical temperature curves, as well as general and local reaction, that there can be no doubt that the disease would have manifested itself before or after arrival here in case they had been shipped.

That this occurred in only one case out of 926 animals tested and out of which 39 head or 4.21 per cent. has reacted and been rejected, speaks highly for the efficiency of the present inspection service on the mainland.

That the 18 head of cattle which reacted to the tuberculin test were affected with tuberculosis there can be very little doubt, as tuberculin has been proven an extremely reliable agent in diagnosing this disease. As the principal number of reacting cattle were bulls, which naturally would have come in contact with large numbers of other breeding stock, there can be no doubt that sooner or later this insidious disease would have gained a foothold in the herds where the affected animals would have been introduced.

In view of the above facts we are justified in concluding that the inspection service as carried out during the past year has prevented the introduction of half a hundred fresh centers of infection from which the respective diseases, glanders and tuberculosis, would have continued to spread until located, checked and eradicated.

IMPORTATIONS OF LIVE STOCK.

During the year 1908 there arrived in the Territory the following live stock, poultry and dogs:

	Port of Honolulu.	Port of Hilo.
Mules	376	374
Horses	139	18
Cattle	93	3
Sheep	6	13
Hogs	1,176	56
Dogs	37	1
Poultry	259 (crates)	105 (crates)
Pigeons	7 (crates)	..

MULES.

The total importation of mules were 750 head as compared to 485 head during 1907 and 295 head during 1906. Of this total a little more than 100 head were imported by the United States Quartermaster's Department and cannot, therefore, strictly speaking, be considered in the same class as mules purchased for sugar plantations or for other purposes as they were simply transferred from one military post to another. Nevertheless a larger number of mules were imported during the past year than during any of the previous years since the establishment of the Division of Animal Industry. This steady increase was predicted in my two previous reports and will undoubtedly continue for at least one year more or until the sugar plantations have obtained their full quota of work animals, the same having been allowed to diminish on account of the great increase in the price of mules during the past few years.

As a general rule the mules which arrived here during the past year were of a better class than those received during the preceding years and were, as a rule, of good size and on an average of satisfactory ages, that is from four to eight years old.

The prices have been somewhat lower considering the class of animals which arrive here, but it is to be hoped that a further reduction will take place during the coming year. *

HORSES.

The total number of horses imported, 157 head, was about the same as that for the preceding year, 139 head. There were only six stallions among these animals as compared to seven for the preceding year.

Of these six stallions there were only two worth mentioning, an imported Percheron stallion, weighing more than a ton, and a German coach stallion, both splendid animals and imported by Mr. A. W. Carter for the Parker Ranch.

Of the rest of the horses 34 were for the Quartermaster's Department, 10 were breeding mares for the Kapapala Ranch and the rest were either driving or work stock.

CATTLE.

The importations of cattle for 1908 falls far below that of the preceding year, being 96 head as compared to 167 head for 1907, and as a general average the animals were all inferior to a ma-

* For further information on this subject see the report of the Deputy Territorial Veterinarian for the district of Hilo on page 155.

jority of those imported during that year. About half of them, that is 57 head, were bulls and a great majority of these were Herefords. The largest importation was 32 heads of bulls for the Kapapala Ranch and 8 bulls and 10 heifers for the Puakea Ranch on Hawaii.

One importation of 21 bulls and heifers contained not less than 12 grades.

This is a poor showing for the year, but there is every indication that the coming year will see the introduction of a larger number of superior animals.

SHEEP.

The 19 head of sheep imported during 1908 are hardly worth mentioning considering that there are nearly 100,000 sheep in the Territory and that fresh blood is badly needed at all times. This Territory should import not less than 100 first class rams every year and until this is done the local flocks will not begin to yield a fraction of what they ought to produce in either mutton or wool. It may, however, be stated here that on January 3d, 1909, there arrived a large importation, more than 100 head, of pure bred Merino rams and ewes from New Zealand, indicating that the prospects of the sheep industry of the Territory will receive the attention it deserves in the near future.

HOGS.

Of the 1,236 hogs which arrived during the past year about 1,200 were for commercial purposes and the remaining number for breeding purposes. Nearly all of the latter were Berkshires. The total number imported as compared to that of the preceding year, 394 head, would indicate that the price of hogs in California has become somewhat lower though not sufficient to allow importations as in 1906 when the same amounted to 3,359 head.

DOGS.

Nearly all of the dogs which arrived here during the past year were pets brought by passengers from San Francisco. Two Japanese pugs arrived from Japan, two German dogs from Bremen, Germany, and two Choro dogs arrived from China.

POULTRY.

The importation of 314 crates of poultry is nearly twice as great as that for 1907 which was only 160 crates. About one-

half of the crates were what might be termed commercial fowl, that is, brown and white Leghorns for egg production, and Plymouth Rocks for table birds. All of these crates were larger, containing from one to three or four dozen birds each. The rest were nearly all fancy birds such as Games, Wyandottes, Orpingtons, as well as a number of the Mediterranean breeds.

These large importations are very encouraging and are undoubtedly due to the efforts of the Hawaiian Poultry Association and its annual poultry show.

IMPORTATION OF LIVE STOCK FROM NEW ZEALAND.

Though not properly belonging to the report for 1908 the fact that the first shipment of live stock from New Zealand has arrived, after more than two years' efforts to bring the same about, would warrant that the subject be discussed here.

On January 3d, 1909, the British steamer "Den of Ruthven" arrived with a consignment of live stock from New Zealand consisting of 13 Shorthorn bulls, 4 Hereford bulls, 65 Merino rams, and 40 Merino ewes.

Fourteen Shorthorn bulis were shipped, but one of these animals had to be shot on account of a broken leg when a week out from Auckland.

The rest of the stock all arrived in good condition though one ram died from over-heating the day after arrival here and before the animals had been unloaded.

As has been stated in my previous reports the importation of live stock from New Zealand to the United States is prohibited and the present importation is due to a special permit which the Agricultural Department at Washington granted in response to urgent requests and on account of the isolated and unique position of this Territory.

The animals were accompanied by numerous certificates pertaining to their breeding, their conditions of health, the live stock sanitary conditions of the districts wherein they had been raised or through which they had passed in transportation, and further to the effect that the animals had been continuously located in the district whence shipped for six months next preceding the date of shipment; that the animals had been shipped in clean disinfected cars direct from the farms where purchased to the port of Auckland, and finally that they were tuberculin tested by a government veterinarian. All of these certificates are required by the regulations of the United States Department of Agriculture, which further specifies that cattle must be kept in quarantine for

90 days from the date of shipment, while sheep must be quarantined for 15 days from the date of arrival.

The sheep in question were therefore loaded directly from the steamer into trucks and taken to the quarantine station in Kalihi where they were kept for 15 days, being submitted to daily inspections, especially in regard to foot-rot, in order to ascertain that they were in perfect health before being released.

The bulls were taken to the new quarantine station on the Beach road where they will be kept until March 19th, they having been shipped from Auckland on December 19th.

All of the animals were pure bred registered stock and if their certificates of registration prove satisfactory to the Department of Agriculture in Washintgon they will be admitted free of duty.

Both the bulls and the Merinos were splendid animals which, if they prove as proficient in imprinting their characteristics on their offspring as former importations from New Zealand have done, will assist materially in the improvement of the beef cattle and the wool sheep of the Islands.

DISEASES AMONG LIVESTOCK IN THE TERRITORY.

In a general way there has been less disease among the livestock in the Territory during the past year than has been the case in the preceding ones, but the prolonged drouth which has prevailed over nearly the whole Territory has caused unprecedented losses so that for the first time in many years beef has been imported from the mainland.

Diseases among sheep has not been reported to any extent as compared to the two preceding years, while among cattle only actinomycosis or lumpy jaw has been of any importance. This disease was fully discussed in my preceding report and there is nothing to add except that the disease seems to continue in the same virulent form which has been prevalent for the past few years and which undoubtedly was brought in with imported stock.

Glanders. Among the horse stock glanders has as usual been the most important disease and has occurred principally on the Islands of Oahu, Maui and Hawaii.

In Honolulu alone not less than 17 outbreaks occurred during the past year, the same being scattered all over the city and suburbs. In regard to localities the following may be mentioned: Palolo valley, Waikiki, Kakaako, Monsarrat road, Moiliili, Bates street, Iwilei, Maunakea street, Asylum road, Parker lane and Kaimuki.

A number of suspicious and exposed cases have been submitted to the malein test and the usual precautions taken in

order to prevent the spread of the disease. In one outbreak of glanders at Iwilei it was found that a badly affected animal had been treated for three weeks by a Japanese named Damura and representing himself to be a veterinarian. The matter was brought to the attention of the Attorney General with the result that Damura was fined fifty dollars for violating the regulations of the Board.

From the Island of Hawaii the Deputy Territorial Veterinarian for the Hilo district has reported several outbreaks, the details of which will be found in his appended report.

The same is the case with the Island of Maui where glanders undoubtedly has been prevalent for a number of years, especially in the Kula district, and where the prolonged drouth and resulting scarcity of feed and water has caused a number of latent cases to develop clinical symptoms. The Deputy Territorial Veterinarian for Maui has submitted several hundred animals to the mallein test and reports a number of cases destroyed.

Epidemic Laryngitis. This disease which was described fully in last year's report assumes a number of different forms and is undoubtedly identical with the disease described by Dr. Elliot as prevailing on the Island of Hawaii, under the name of "Endemic Catarrhal Fever." The disease is due to a streptococcus infection and is very difficult to get rid of when once it gains entrance into a herd or stable.

According to Dr. Elliot's report, as well as to information obtained from other sources, this disease has been very prevalent on several of the largest ranches on Hawaii and has caused considerable losses in a number of plantation stables.

For a full description of the symptoms, course and treatment of this disease those interested are referred to Dr. Elliot's report as well as to the report of this division for last year.

Cerebro Spinal Meningitis. This disease which occurs often on the Island of Oahu has been reported from Maui as occurring in epidemic form in two plantation stables. In one case six animals were affected at the same time, five of which died, and in another case three animals were taken sick simultaneously, but two of these recovered.

The disease is an extremely difficult one to deal with, very little being known in regard to its cause and the various treatments recommended seem to be of little value. Isolation of the affected animals and thorough disinfection of the premises where the diseased animals have been kept seems

to be the only means of checking the outbreak.. In most cases where the animal does not die during the first stages of the disease it terminates with paralysis of the pharynx which generally causes the death of the animal through starvation or through pneumonia caused by the entrance of particles of food into the lungs through the paralyzed pharynx.

Tuberculosis. There is at the present time a very strong movement in the United States pertaining to the improvement of the milk supply with special reference to the protection of human beings and especially children against contamination with milk containing tubercle bacilli.

A recent publication by the Bureau of Animal Industry of the United States Department of Agriculture has shown how the environment of tuberculous cattle is permeated with tubercle bacilli, which are often discharged in enormous numbers with the manure, and how easy it is for the milk to become infected. The writer of the bulletin in question is of the opinion that the milk as drawn from the cow very rarely contains tubercle bacilli, except in cases where the milk glands are actually infected with the disease, and that the too frequent discovery of tubercle bacilli in commercial milk and butter is due to contamination after the milk has been drawn. It is further demonstrated that the general condition or appearance of a tuberculous animal gives no indication as to the time when it will begin to distribute tubercle bacilli and become dangerous; that the milk from all tuberculous cattle irrespective of the condition of their udders should be regarded as dangerous and that even the milk of healthy cows, if it is drawn in the environment of tuberculous cattle may contain tubercle bacilli. His conclusions that the manure is the most dangerous factor in the dissemination of tubercle bacilli by cattle affected with tuberculosis and that milk from tuberculous cows with unaffected udders is free from infection until it has become contaminated with manure or some other material that contains tubercle bacilli, from the outside of the cows or from their environment, would seem to indicate that sufficient stress cannot be laid upon the promulgation and enforcement of rules and regulations pertaining to the sanitation of all dairies and to the conditions of cleanliness under which the milk is drawn from the cows and protected from infection before delivery to the consumer.

That tuberculosis exists among the dairy cattle of the Territory to a considerable extent has been fully demonstrated by the tuberculin test and by numerous post mortems of animals which have reacted to this test. The records of the Territorial Board of Health also indicate that human tuberculosis is a common disease in the Territory especially among

the native population. It must further be admitted that there is probably no state or territory in the Union which expends less money on dairy and milk inspection or in which less efforts are being made to improve the sanitary conditions of the milk supply. The meat and milk inspection is at the present time in the hands of the Territorial Board of Health which employs one layman in inspecting dairies and obtaining samples of milk for examination by the Food Commissioner.

An international congress on tuberculosis was to be held in Washington, D. C., during September and October of the past year, and as the Territorial Board of Health did not send a representative the Board of Commissioners of Agriculture and Forestry decided to send the writer.

INTERNATIONAL CONGRESS ON TUBERCULOSIS.

The congress opened in Washington, D. C., on September 22 and continued until October 12. Every civilized country in the world was represented, the delegates numbering more than three thousand and all of the most prominent authorities on the subject of tuberculosis were present and took part in the discussions. Among these may be mentioned Prof. Robert Koch of Berlin, Germany; Prof. G. Sims Woodhead, Cambridge, England; Prof. S. Arloing of Lyons, France; Prof. B. Bang of Denmark; Dr. J. G. Rutherford of Ottawa, Canada; Prof. V. A. Moore of Cornell University; Dr. Leonard Pearson of the University of Pennsylvania and Prof. Theobald Smith of Harvard University.

The section of the Congress in which most interest was taken was Section VII entitled "The Relationships Between Tuberculosis of Animals and Man."

As might have been expected Prof. Koch maintained his standpoint presented at the two former Congresses to the effect that human beings were little susceptible to animal tuberculosis. He admitted that the bovine form of the tubercle bacilli had been found in children suffering from tuberculosis but that no authentic case of pulmonary tuberculosis due to the bovine bacillus had ever been demonstrated in a grown person. He even went so far as to say that the danger of infection of even children from milk from tuberculosis animals might be considered as a negligible quantity.

In these views, however, Prof. Koch stood in splendid isolation. Not a single one of the other prominent scientists agreed with him to any extent. Numerous papers were read on the subject of bovine tuberculosis affecting man and a number of authentic cases were submitted of the infection of

grown persons by the bovine form of tuberculosis. Nevertheless Prof. Koch adhered to his views and an open rupture was only avoided by holding a couple of secret sessions in which the most prominent investigators discussed the subject with Prof. Koch, without, however, reaching any agreement except the postponement of further opinions on the subject until the meeting of the next Tuberculosis Congress, three years hence.

Of the many other papers pertaining to tuberculosis in its relation to man the following may be mentioned:

Dr. A. D. Melvin, Dept. of Agriculture, Washington, D. C.—The economic importance of tuberculosis of food-producing animals.

Prof. Josef Svenson, Stockholm, Sweden.—An inquiry as to whether or not the tuberculosis taint can be acquired by the inhalation of dust containing tubercle bacilli.

Dr. E. C. Schroeder, Dept. of Agriculture, Washington, D. C.—The occurrence and significance of tubercle bacilli in the feces of cattle.

Dr. John R. Mohler and Henry J. Washburn, Dept. of Agriculture, Washington, D. C.—Review of recent investigations on animal tuberculosis by the United States Bureau of Animal Industry.

Prof. Theobald Smith, Boston, Mass.—The relations of human and animal tuberculosis with special reference to the question of the transformation of human and other types of the tubercle bacillus.

Prof. G. Sims Woodhead, Cambridge, England.—The problems to be solved in dealing with human and bovine tuberculosis.

Drs. Johannes Fibiger and C. O. Jensen, Denmark.—Human and bovine tuberculosis and the tubercle bacillus.

Dr. M. P. Ravenel, Madison, Wis.—Recent developments in regard to the relations of human and bovine tuberculosis.

Dr. R. R. Dinwiddie, Experiment Station, Ark.—The susceptibility of cattle to the virus of surgical forms of human tuberculosis.

Dr. A. W. Bitting, Purdue University.—The infection of swine from tuberculous cattle.

Dr. George B. Jobson, Franklin, Pa.—The tuberculin test; an efficient agent for the detection of bovine tuberculosis.

Dr. S. B. Nelson, State College, Washington.—A report of the results of the continued injections of tuberculin upon tuberculous cattle.

Prof. B. Bang, Copenhagen, Denmark.—The control of tuberculosis of cattle in Denmark.

Dr. J. G. Rutherford, Ottawa, Canada.—The control of bovine tuberculosis in Canada.

Prof. V. A. Moore, Ithaca, N. Y.—The value of tuberculin in the control of tuberculosis in herds.

Prof. M. H. Reynolds, University of Minnesota.—The problem of bovine tuberculosis control.

Dr. J. W. Connaway, University of Missouri.—The enlistment of the educational forces of the state in the suppression of tuberculosis of animals.

Dr. Leonard Pearson, Philadelphia, Pa.—The prevention of tuberculosis of cattle by vaccination.

Dr. Otto G. Noack, Reading, Pa.—Meat and dairy herd inspection as preventive measures against the spread of tuberculosis among cattle.

With the exception of the paper read by Prof. Bang of Denmark, who is the originator of the so-called "Bang Method" for the eradication of tuberculosis from dairy herds, the methods recommended by most of these papers required large sums of money and the employment of large numbers of sanitary officials and assistants, but varied to a certain extent in the recommendation as to the disposal of reacting animals. None of the methods recommended would seem practicable so far as this Territory is concerned, at least at the present time.

My own scheme, that is the establishment of a quarantine farm on land supplied by the Territory and operated as far as possible with convict labor under the joint supervision of the United States Experiment Station and the Board of Agriculture and Forestry, was received with much applause, though many doubted the feasibility of the scheme at least as far as their own local conditions were concerned. The compulsory testing of all dairy stock and the isolation of all reacting animals on such a quarantine farm, the animals to be bred and utilized in the same way as on any ordinary farm, with the exception that the Bang method be employed in segregating and raising all calves born on the farm in such a way as to prevent their becoming infected with tuberculosis, would, in my opinion, prove more economic than the wholesale destruction of all reacting animals and the paying of an indemnity to the respective owners.

The Bang method consists in the absolute segregation of all reacting animals from the non-reacting ones, either on the same farm or on separate ones. As soon as a calf is born it is removed to the non-reacting group, it being conceded that with extremely few exceptions calves are born free from tuberculosis even if the mothers are affected with the disease. At the age of six months the calves are tested and if they do not react they are permanently admitted to the non-reacting herd. All animals which show physical symptoms of tuberculosis are destroyed and only those which are apparently healthy, but which react to the test are retained in the reacting division and their milk used for dairy purposes under proper precautions, that is after being pasteurized.

In discussing this subject with Prof. Bang from Denmark, he made the plausible remark that if it would and did pay the owners of tuberculous cows to retain them in their herds, why should it not pay to run a large dairy composed exclusively of reacting animals, showing no physical symptoms of tuberculosis, and at the same time raising a herd of clean, young stock. With a good animal husbandman as manager of the farm, with the Federal Experiment Station staff super-

vising the breeding of the stock and the growing of farm crops and with the general health of the animals attended to by the Territorial Veterinarian, it seems to me possible that the County of Oahu at least could be freed from animal tuberculosis at very slight cost beyond the initial expense of establishing an official quarantine farm.

In the meantime I have to admit that my attendance at the Tuberculosis Congress in Washington has made me feel less apprehensive in regard to bovine tuberculosis and its transmission to man, especially in the Territory of Hawaii, where both man and cattle lead an outdoor life the year around, that is—if such rules and regulations can be promulgated and enforced that will insure modern sanitation in all dairies, the proper handling of all commercial milk and the superintendence of the health of all dairy cattle furnishing commercial milk by competent veterinarians. This I believe can at the present time only be accomplished through a co-operation of the Territorial Board of Health and the Board of Agriculture and Forestry.

INTER-STATE ASSOCIATION OF LIVESTOCK SANITARY BOARDS.

The twelfth annual meeting of the Inter-State Association of Livestock Sanitary Boards, held in Washintgon, D. C., September 14, 15 and 16, was the most successful in the history of the Association.

The writer, who was one of the charter members of the Association, timed his arrival in Washington so as to attend this meeting, and entered the Board of Agriculture and Forestry as a member of the Association.

There were representatives present from twenty-four states besides the Hawaiian Islands. The Federal Bureau of Animal Industry sent not less than twenty representatives, which contributed greatly to the success of the meeting.

The forenoon of the first day was entirely taken up with the address of welcome by Dr. A. D. Melvin, Chief of the Bureau of Animal Industry, and the address of the president, Dr. Charles G. Lamb, State Veterinarian for Colorado, besides the usual routine business.

A committee was appointed to report at the next annual meeting for the purpose of compiling and arranging the laws and regulations of the various States governing livestock sanitation, together with a list of sanitary officers.

Another committee was appointed to draft a Livestock Sanitary Law to serve as a basis for uniform legislation in

the various States; also to prepare a statement showing the fundamental principles which should enter into the Livestock Laws; this committee to report at the next meeting of the Association.

Dr. A. D. Melvin read a paper on "Control of Hog Cholera by Serum Immunization." The importance of this paper is best illustrated by quoting the resolution which was passed by the Association and which reads:

"Whereas, Through the untiring efforts of the Bureau of Animal Industry of the United States Department of Agriculture it has been demonstrated that a vaccine can now be produced at a nominal cost, which, when introduced into healthy hogs will immune them to that disease known as hog cholera, be it

Resolved, That this association, in view of the efficacy of the vaccine as a preventive and control measure, heartily recommend that all State Legislatures be requested by their representatives now assembled, to appropriate sufficient funds whereby such vaccine may be manufactured and distributed under the direction of the state authorities charged with the control of animal contagious and infectious diseases of their respective states. Be it further

Resolved, That the delegates of states represented at this convention extend to the Hon. Secretary of Agriculture, their appreciation of the excellent work of his officials in solving the control of a disease which annually causes an immense monetary loss, not only to swine breeders but to the entire United States."

I have requested that a number of separates of this paper be furnished this office for distribution among the hog raisers of the Territory.

The entire second day was given to the subject of tuberculosis. The following papers were presented:

"Federal, State and City Co-operation in the Eradication of Tuberculosis," D. F. Luckey, Missouri.

"Control of Tuberculosis in Domestic Animals in Pennsylvania," L. A. Klein, Pennsylvania.

"Ways and Means of Eradicating Tuberculosis in Domestic Animals," O. E. Dyson, Illinois.

"Bovine Tuberculosis in Louisiana and Some Other Southern States," W. H. Dalrymple, Louisiana.

"Control of Tuberculosis," A. D. Melvin, Washington, D. C.

"State Meat Inspection," J. M. Wright, Illinois.

These papers were discussed collectively by men who have been engaged in the work of control of tuberculosis in the

various states and for the general government, for the past ten or twelve years; men who knew what they were talking about, and who covered the subject from all standpoints.

The following resolutions pertaining to tuberculosis were adopted by the Association:

“Resolved, That the management of State Fairs and Livestock Expositions be requested to assist in the eradication of tuberculosis to the extent of prohibiting the exhibition of all cattle for prizes, or their exposure for sale, unless they are officially certified to as having received the tuberculin test within a period of one year, and no reaction shown.

Resolved, That the Bureau of Animal Industry be requested to assist as far as possible in the testing of cattle for breeding and dairy purposes, intended for interstate shipment in those states requiring this test and requesting such assistance from the Bureau.

Whereas, It would appear the authorities of a certain state are placing in the hands of laymen tuberculin which is applied by them under no restrictions; as the test is a delicate one, requiring an intimate knowledge of conditions unknown to layman, which through ignorance on the part of the one applying the same, has raised the question as to the reliability of the test, be it

Resolved, That this association condemn the distribution of tuberculin by state authorities to others than veterinarians.

Resolved, That the distribution and sale of mallein and tuberculin should be regulated by law, with the object of preventing its fraudulent use.”

On the third day “glanders” was the principal subject. A paper was read by the writer entitled “Glanders in Hawaii, and the Efforts of This Territory to Protect Itself Against the Repeated Introduction of This Disease from California.”

The discussion of this paper was opened by Dr. R. A. Archibald, of California, who corroborated and emphasized the writer’s statements in regard to the sanitary conditions in California, as far as glanders is concerned.

The benefits resulting from this discussion have already been set forth on the previous pages of this report.

The following resolution pertaining to glanders was adopted by the Association:

“Whereas, It is the consensus of opinion of all veterinarians experienced in sanitary work that a public watering trough is the most common source of the spread of glanders and other contagious diseases, be it

Resolved, That the Inter-State Association of Livestock Sanitary Boards strongly recommends closing all public

watering trough in and during any outbreak of glanders; and be it further

Resolved, That hydrants from which teamsters may draw water in private buckets be substituted for the type of watering-troughs now in common use."

A great number of other papers dealing with diseases not known in this Territory were read and discussed and the meeting adjourned after passing the following resolution:

Whereas, The success of the 12th annual session of the association has, in a large measure, been due to the assistance rendered by officials of the Department of Agriculture, be it

Resolved, That this association extend to said officials their hearty thanks for the able and scientific papers presented; for their assistance in obtaining for the association a complete stenographic report of the proceedings, and in divers other ways, which have been conducive in making this session the most successful in the history of the association.

THE PATHOLOGICAL LABORATORY.

During the first year of the present biennial period the work of the pathological laboratory was practically limited to the examination of pathological specimens for diagnostic purposes. During July of the past year, however, the services of an expert laboratory assistant was secured when the Board appointed Dr. Leonard N. Case, a graduate of the veterinary department of Cornell University, to the position of Assistant Territorial Veterinarian. Under Dr. Case's management the equipment of the laboratory has been completed and the systematic investigation of various diseases commenced.

The museum specimens, which had been collected through a number of years, have also been gone over, the solutions changed and each properly labeled.

All the material thus far collected from the disease known as "Red Water" has been examined and while no definite cause has so far been ascribed to this disease we have found, in many of the sections, an oval organism belonging to the family Protozoa. This is most likely the true cause of the disease, as this form of organism is known to produce similar symptoms and pathological lesions in cattle and other species of animals.

Nothing more can be done with this until fresh material can be procured, the organism isolated, grown on artificial culture media and experimental inoculations made. This disease constitutes one of the most important under investigation.

We have now through many difficulties secured the necessary materials for the carrying out of the Serum test for glanders. Artificial culture media have been made and are now ready for use. We still have to procure a stock of guinea pigs and construct pens and cages for them.

We aim to keep on hand all the materials necessary for the investigation of any disease of livestock in this Territory. The Laboratory should be used by all the practicing veterinarians of these islands as well as by the owners and breeders of livestock as an aid in diagnosis, and they should feel free, at all times, to send material here for investigation. It is only by so doing that the laboratory will become of general value to the entire Territory and the livestock interests receive the most benefit from it.

The lines of work which will be conducted in the laboratory in the future may be divided into two parts, viz:

(a) The investigation of infectious diseases such as Osteoporosis, Osteomalacia, Red Water, etc., and the examination of such material as may be sent in for diagnostic purposes.

(b) The control and eventual eradication of glanders by the use of the blood serum test as it is to be applied to affected and suspicious animals.

This is one of the most important branches of the work. The test is a very delicate one and can only be performed in a laboratory fully equipped for it.

The observations of recent investigators all point to the definiteness and sureness of the reaction. It is complicated by no other disease which may be present in the animal body and is therefore much more satisfactory than the Mallein test used at the present time.

We also plan to make a careful blood examination of all animals shown to be glandered in order to obtain data in regard to the condition of the blood in animals affected with this disease.

The microscopic examination of feces of cattle to determine the true nature of the acid fast bacteria so prevalent there, will now be supplemented by cultural and inoculation experiments. This line of work is of vast importance to the dairy industry of the Territory, and its furtherance is commended by the pathologists of the Bureau of Animal Industry.

VETERINARY INSPECTION AND SANITARY SERVICE FOR THE ISLANDS OF HAWAII, MAUI AND KAUAI.

As indicated in my report for last year negotiations for the appointment of Deputy Territorial Veterinarians had been carried on between the Board of Commissioners of Agriculture and Forestry and the Hawaiian Sugar Planters' Association, the Boards of Supervisors for the various counties outside of Oahu and the Hawaiian Livestock Breeders' Association, but without any definite arrangement being arrived at.

It became, however, more and more apparent that the presence of veterinary sanitary officers was absolutely required in at least certain districts outside of the County of Oahu, and in the beginning of 1908 negotiations were again entered into, this time with the local Sugar Planters' Association of Hawaii.

After a number of conferences with the agents of the various plantations and ranches in the said district an agreement was reached whereby the said plantations and ranches consented to provide a salary of \$100 per month for a Deputy Territorial Veterinarian in compensation for all official work performed by him.

The text of this agreement reads as follows :

APPOINTMENT.

(1). The Territorial Board of Commissioners of Agriculture and Forestry upon the recommendation of the Hawaiian Sugar Planters' Association appoints Dr. H. B. Elliot of Hilo, Hawaii, to be Deputy Territorial Veterinarian and Livestock Inspector thereby vesting in him the same prerogatives and rights as those enjoyed by the Territorial Veterinarian.

COMPENSATION.

(2). The plantations and ranches in the district assigned to Dr. Elliot agree to pay him a salary of \$100 per month in compensation for all official work performed by him in connection with the importation of livestock and the eradication and suppression of infectious and contagious diseases among livestock.

OFFICIAL DISTRICT.

(3). The official district of the Deputy Territorial Veterinarian stationed in Hilo shall be as follows: All that portion of North Hilo district lying south of the Kawali gulch and the districts of South Hilo, Puna and Kau.

DUTIES.

(4). It shall be the duty of the said veterinarian, (a) to inspect all livestock arriving directly in the said Territory from mainland of the United States in accordance with the rules and regulations of the Board of Agriculture and Forestry; (b) to respond without delay to all outbreaks or suspected outbreaks of infectious or contagious diseases among livestock and especially glanders, upon notification of the same; to make a thorough investigation as to the nature, cause and origin of the outbreak and to take such measures for its suppression and eradication as required by the rules and regulations of the Board; (c) to make periodical examinations of all horse stock as far as possible within the boundaries of the plantations and ranches entering into this agreement and as often as shall be agreed upon between the various managers and the said veterinarian, it being understood that the necessary assistance for this work shall be provided by the parties requesting the inspection; (d) it shall further be the duty of the said veterinarian to carry out such instructions as he may receive from the Territorial Board of Agriculture and Forestry under his appointment as Deputy Territorial Veterinarian and to enforce the statutes, rules and regulations pertaining to the office of the Territorial Veterinarian.

This agreement, it was understood, was in no way to interfere with Dr. Elliot's private contracts with the various plantations in his district, and it has been found that during the nine months in which it has been in force it has given satisfaction to all concerned. As will be seen from the accompanying report of Dr. Elliot's, he has done much and good work within his district and has at the same time looked after the inspection of livestock intended for ranches and plantations outside of his district on the Island of Hawaii.

In two cases consignment of mules were landed at Mahukona, which necessitated, in one case, that the Assistant Territorial Veterinarian went from Honolulu to Mahukona in order to inspect the stock and in the second case that Dr. Elliot went from Hilo to Mahukona for the same purpose.

This appointment of a deputy Territorial Veterinarian for

the Hilo district leaves, however, the greater part of the Island of Hawaii, including the Hamakua and Kohala districts, without any protection, except such as can be extended from Hilo or from Honolulu. In my report for last year it was recommended that a deputy be appointed for the northern part of Hawaii, to be stationed either in Hamakua or else at Kamuela, the latter place being about midway between Kohala and Hamakua.

The Kohala plantations signified their willingness to co-operate with the Hamakua plantations and with the Parker Ranch for the purpose above mentioned, but opposition of undefined nature was met with from the Hamakua district and no deputy has been appointed up to the present time. There is a strong feeling in the district assigned to Dr. Elliot that the good to result from his appointment will, to a great extent, be offset by leaving his district open and unprotected toward the north, especially in view of the fact that glanders has prevailed in the Hamakua district for a number of years.

At the same time, the managers of plantations and ranches in the Hilo district, who participate in the payment of the Hilo veterinarian's salary do not consider it reasonable that Dr. Elliot should give his time and services for the inspection of livestock intended for plantations which have refused to contribute anything to his salary.

In regard to the Island of Maui negotiations were opened during the month of May and a meeting of stock owners and raisers was held at Kahului for the purpose of acting on the suggestion of the Board of Agriculture and Forestry, that a resident veterinarian be maintained on Maui. It was the unanimous opinion of those present that an official veterinarian was needed and a temporary organization was formed in order to draw up plans for permanent organization and to make recommendations as to how the salary of a veterinarian should be provided for.

It was, however, not until August of the same year that this organization took definite action and requested that the Board of Agriculture and Forestry appoint Dr. J. C. Fitzgerald to be Deputy Territorial Veterinarian for the Island of Maui.

The agreement between the Board and the local organization was in every respect similar to that which resulted in Dr. Elliot's appointment and the compensation was likewise \$100 per month.

From reports received from Dr. Fitzgerald he has found more work to do in the line of locating and eradicating infectious and contagious diseases than was expected, and

during the few months since his appointment he has had several outbreaks of glanders to deal with besides outbreaks of other infectious diseases.

The Island of Maui is an extensive district for one man to deal with, but the fact that no veterinarian has ever been stationed on that island before, necessarily made the work more difficult than would otherwise have been the case, requiring as it did a great deal of organization.

In the Hilo district a temporary quarantine station has been built during the past year but this has proved not to be large enough at all times to accommodate the importations of livestock.

On Maui no provisions have so far been made for the quarantining of either imported livestock or of animals affected with or suspected of suffering from contagious diseases and it is therefore strongly recommended that the quarantine station in Hilo be sufficiently enlarged to meet all requirements and that a quarantine station be provided for the Island of Maui.

In regard to the Island of Kauai neither inspection or veterinary sanitary service has been established, as a result of which, all livestock intended for importation to this island has been entered at the port of Honolulu for inspection and, whenever necessary, for quarantine.

In view of the experience of the past year with local inspection and sanitary service on the Islands of Hawaii and Maui, it would seem highly desirable if such service could be established and a quarantine station be provided for the Island of Kauai.

Report of the Deputy Territorial Veterinarian for the Hilo District.

BY H. B. ELLIOT, M. R. C. V. S.

GENERAL OBSERVATIONS.

The appointment of a Deputy Territorial Veterinarian for the districts of North and South Hilo, Puna and Kau was made in the earlier part of the year, the duties commencing on March 1st; statistics, however, covering the whole period are in my possession and are included in this report. The year was an exceptional one both as regards the unfavorable weather conditions which prevailed over the greater part of the island, and the unusual amount of contagious diseases among the live stock. The leeward side of the island suffered from a prolonged drought; but in the vicinity of Hilo the rainfall was excessive and, which made matters worse, very evenly distributed throughout the twelve months, only forty-seven clear days being registered at Papaikou.

PORT INSPECTION.

During the year 1908 there arrived at the port of Hilo the following live stock, poultry, dogs and cats:

Mules	374
Horses	18
Cattle	3
Sheep	13
Hogs	56
Dogs	1
Cats	1
Poultry (crates)	105

Ninety-seven per cent. of the mules were either purchased by, or consigned to the sugar plantations, the average price being about \$260 delivered on the plantation. The majority of these animals were large sized, of suitable conformation for the work desired, and distinctly superior to the importations of recent years. The proportion of very aged and defective animals was much less than usual, but the plantations would save money if more stringent precautions were taken before purchase. Orders should specify maximum age and minimum weight required, and agents instructed to submit all animals to a competent and reputable

veterinarian to determine, firstly, that they comply with the specifications laid down, and secondly, that they are free from any obvious and visible deformity or unsoundness. In view of the high prices that are paid for mules on the coast, and the expenses attending shipment, it would seem advisable that this comparatively inexpensive safeguard (about one dollar per head) be adopted by buyers. It is suggested, also, that as mules of the class needed here are scarce in California, orders should be sent in at least three months ahead of time.

Most of these consignments were conveyed on steamers, and arrived in much better condition than in former years when sailing vessels were principally employed for this purpose. No cases of contagious disease were detected at these ports.

LOCAL INSPECTION.

A large number of animals, mule and horse stock, belonging to the poorer class of owners—stage drivers, small storekeepers, plantation laborers, etc.,—were rounded up in the Hilo and Kau districts and examined for contagious diseases. There can be no doubt that this is the medium by which glanders is carried from one district to another. More of this work might profitably have been done, but it was interfered with in the latter part of the year by the additional duties arising from the quarantine regulations at the ports and the widespread outbreak of catarrhal disease.

QUARANTINE STATION AT HILO.

The Board having recognized the necessity under the new regulations of providing a proper and suitable place for the quarantining of animals at this port a careful and systematic search for a desirable site was commenced in June. It was proposed to locate this station on land belonging to the Territory, but none could be obtained that was appropriate for this purpose and, finally, upon my advice a piece of land was rented from the Hilo Sugar Company. This is situated on the Piipihonua tract, has an area of about two acres, and was chosen because it was the only site offered that combined the advantages of a reasonable rental, permanency of tenure, convenient water supply, and proper facilities for isolation. Six hundred dollars have been expended in enclosing the property with a substantial wire fence (fifteen feet inside of the outer walls and fences) which, also, divides it into two paddocks, and in the erection of a feed room and two sheds each capable of accommodating fifteen animals. Further improvements in the sheds to afford more complete protection against the weather will be needed and their capacity should be enlarged.

An additional small stable in which animals showing suspicious symptoms of contagious disease can be separated and kept under observation is also necessary.

CONTAGIOUS AND INFECTIOUS DISEASES.

GLANDERS.

Four outbreaks of this disease, two of which are still under observation, have been noted and six animals have been destroyed. Over eighty special visits were made to these stables for the purpose of examining the in-contact animals and all presenting suspicious signs of this disease were immediately quarantined until a diagnosis was possible. The last outbreak was discovered on December 30th in a stable in Hilo belonging to a Chinese stage driver. This was a well developed case and the animal was destroyed and the premises disinfected.

Four other horses belonging to the same stable are at present in quarantine pending the application of the mallein test. I am indebted to Dr. Mizimoto for reporting this case. Acknowledgment is here made of the willing and effective coöperation of Mr. D. S. Bowman, local inspector for the Board of Health, in the work of disinfecting the various stables in which glanders has appeared.

ENDEMIC CATARRHAL FEVER.

Nature and Occurrence.—A specific, highly contagious disease affecting the respiratory system of equines was very prevalent on the Island of Hawaii during 1908. It was first noticed in the northern districts, gradually spread towards the south, and is now widely disseminated over the greater part of the island. In the year 1897 this disease was brought into this country in a cargo of horses from San Francisco. At that time it assumed a marked pneumonia type, caused great loss to stock owners, and did not disappear until 1902. Since then no cases have been observed until the present outbreak. This disease is differentiated from the Epizootic Laryngitis described in the annual report of the Board for 1907 by its slow progress through the country, persistence of infection in individual stables for long periods of time, marked preference for young animals, severer febrile disturbance, and higher mortality percentage.

The most susceptible subjects are young horses from three to six years of age, and these are usually the first animals attacked in an outbreak; nevertheless, maturity confers no immunity, and many severe cases are noted in animals of ad-

vanced age. For some unknown reason the mule is singularly insusceptible to this disease—a fortunate circumstance for the plantations—and when infection does take place the resulting disease is generally of a tractable and easily controlled nature. An animal that has suffered from one attack is not necessarily protected against subsequent infection because we have seen several animals returned to isolation stables after three or four months have expired. The worst cases are seen at the commencement of an outbreak; where proper measures are taken those that follow tend to a milder and more benign form. The infection may persist in a stable for months and can only be eradicated by periodical and thorough disinfection. The disease usually progresses through a stable in a slow and irregular manner; in one large stable we have averaged about four cases in the isolation hospital every day since the first case was detected in August. Transmission from one animal to another may be direct, or the contagion may be spread by such intermediate channels as the air, forage, manure, watering-troughs, mangers and possibly by stable attendants and owners.

It is probable that the infective agent is saphrophytic in its habits, that is, capable of living indefinitely outside of the animal body in soil, dust, etc., and that infection is also maintained by animals apparently recovered but still excreting virulent material from the respiratory passages.

Symptoms.—The primary appearances that indicate infection are dullness, particularly manifested when at work, and partial, or total loss of appetite. The thermometer at this stage will reveal a surprisingly high temperature ranging from 103° to 106° . After from one to three days the disease resolves itself into one of two distinctive types according to the seat of invasion.

In the first, the “Strangles” type, the predominant symptoms are those of a more or less violent invasion of the air-passages of the head and throat. A copious, white, flocculent discharge flows from the nostrils. Soreness of the throat is evidenced by a harsh, irritable cough, particularly when feeding, and water is swallowed with a peculiar “gulping” effort. When the mucous membranes of the larynx are acutely implicated respiration is roaring and distressed, sometimes to such an extent that the animal’s life is threatened and relief by the operation of tracheotomy is imperative. Hard swellings, which may be single or multiple, small or large, form between the rami of the lower jaws, on the sides of the cheeks, or in the vicinity of the parotid gland; these increase in size, suppurate, and break, evacuating large quantities of pus. Excep-

tional symptoms are: formation of abscesses in other parts of the outer surface of the body, or in the internal cavities of the chest and abdomen; oedematous swellings of the genitals, under surface of the abdomen and legs; and those pertaining to complications which may develop at any stage of the disease in the digestive, nervous and circulatory systems. In aggravated cases of catarrh extension of the disease to the lung tissues frequently takes place; this constitutes a grave condition and is usually premonitory of a fatal termination.

In this type prognosis, as a rule, is favorable and the majority of cases recover after an illness of two or three weeks duration. The mortality percentage depends upon the care that is exercised in management and varies from *nil* to five per cent. of animals affected.

Any of the above mentioned symptoms may be found in the second, or "Pneumonia," type of this disease, there being no definite line of demarcation between the two forms, but the course it more generally follows is that of the description here appended: "The visible mucous membranes are suffused with a blush; the expired air feels hot on the hand; the breathing, 30 to 40 per minute, is short and accompanied by much lifting of the flanks (*labored*); the cough is deep as if coming from the depths of the chest; the legs are placed apart, the elbows turned out and the head protruded to facilitate breathing; the nose is turned to an open door or window if any such is available; the contraction of the muscles of the face, the dilated nostrils and the retracted angle of the mouth give an anxious expression to the countenance; the eyes are semi-closed; the pulse is full but soft (*oppressed*), and beats from 48 to 70 per minute; the bowels are slightly costive, the urine scanty and high colored; the skin inelastic (*hidebound*), harsh and dry, though sweats may bedew it in parts; the loins insensible to pinching; and if there is any discharge from the nose it consists only in a reddish (*rusty*) colored mucus.

. . . The nature of the symptoms will vary according to the extent and character of the inflammation, from mild febrile reaction, with excited breathing and slight crepitation, to the more severe varieties in which the intensity of the symptoms is such as to threaten suffocation. . . . A marked feature of pneumonia in solipedes is that the patient obstinately stands in one position and never lies down so long as the severity of the inflammation lasts. . . . The tendency of pneumonia is to a crisis and recovery. . . . Among the more *favorable indications* are the manifest abatement of the high bodily temperature and febrile symptoms generally, the increasing ease and regularity of the breathing, the greater force, distinctness, and slowness of the pulse, the permanent

return of warmth to the limbs, the softer and more elastic feeling of the skin, the recovery of the appetite, and above all, the turning of the nose from the open window or the retention of the recumbent position for any length of time. If on the contrary the disease takes an *unfavorable turn*, some such signs as the following will manifest it: increasing rapidity and embarrassment of the breathing; smallness and indistinctness of the pulse, which is increased to perhaps 100 beats per minute; tumultuous heart's action, the impulse of which is felt behind the left elbow; a more laborious working of the flanks; frequent despondent looking at the flanks; pawing with the fore feet, lying down and as suddenly rising again; permanent coldness of the extremities; hanging head with great dullness and despondency of expression; dull, sunken, lustreless eye; hanging lower lip; leaden hue of the nasal mucous membranes; convulsive twitching of the muscles of the surface; reeling in gait, and extension of crepitation over all the still pervious lung." The above excellent description by Professor James Law is very applicable to the cases under consideration and is inserted as an assistance to the owner in diagnosis.

The mortality percentage in this type of the disease varies from *nil* to fifteen or twenty per cent. of the cases presented.

Prophylaxis.—Early detection of the existence of the disease is very essential to recovery, and to this end we find it useful to instruct employes in charge of large stables in the use of the clinical thermometer. This is a simple operation and one in which even Japanese stable attendants quickly acquire proficiency. It is a practical impossibility to take the temperature daily of all the animals in a plantation stable, but where this can be done it will be found a wise measure of precaution. Under any circumstances the temperature of animals that give rise to suspicion should be ascertained as soon as possible. Neglect of this is a fertile cause of high mortality because every day that an animal is worked after infection materially lessens the chances of recovery. Those showing a rise to 102° or over should be immediately isolated in a comfortable and airy shed. If the weather is chilly at night a warm blanket will be found beneficial, especially when the affection is localized in the pulmonary tissues, but it should be removed during the day time. The diet should be soft and easily digestible—bran mashes and green forage—and given frequently in small quantities at one time. In the milder catarrhal cases, if the fever does not run over 103° and appetite is well maintained, very little medicinal treatment is required; the more serious cases demand the experience and skillful attention that only

a veterinarian is able to supply. Stables in which large numbers of horses are congregated must be thoroughly disinfected, and if the infection persists this should be repeated at regular intervals. It is my experience that where these prophylactic measures are rigorously enforced the cases under treatment are of a much milder type and the mortality percentage is very small.

OSTEOPOROSIS.

Very few cases of this disease which formerly played havoc in the plantation stables in the "wet" districts of this island have been noted during the past twelve months. This is fortunate because the economic loss in an extensive outbreak is very great, and, on account of our absolute lack of knowledge of its origin and methods of transmission, it is an even more difficult disease than glanders to eradicate.

STRONGYLOSIS.

This disease, due to a parasitic nematode, is described in the annual report of the Board for the year 1906. Only one serious outbreak has been encountered, but post mortem examinations reveal that this is the most usual cause of sudden death among plantation stock and of the anaemic condition often seen in young newly purchased Hawaiian mules. So far as the plantations are concerned the best preventive measures are stall feeding, attention to water supplies, and change of pastures. It is well known that limited areas of land on which stock are turned out year after year become "tainted" with entozoic ova; for this reason a change of pasture for plantation animals every three or four years is desirable.

Report of the Deputy Territorial Veterinarian for the District of Maui.

BY J. C. FITZGERALD, M. R. C. V. S.

My appointment as Deputy Territorial Veterinarian for the district of Maui went into effect on September 1st of the past year and the following report therefore covers only a period of four months, the principal part of which has been occupied in visiting as nearly as possible all sections of Maui for the purpose of sizing up the situation and organizing the work in general.

My investigations during the above mentioned period have fully demonstrated that glanders has been prevalent to a considerable extent in a number of districts and that the prolonged drouth has caused a large number of insidious cases of glanders to assume the acute form and cause the death of many affected horses.

The horse stock on the various ranches has been rounded up and examined and whenever possible the outside horse stock, that is, individual animals belonging to Hawaiians, Portuguese and Orientals, have been collected and inspected, and when this was not possible, a house to house inspection has been made. This work has been greatly facilitated by the sheriff of Maui and his staff, who have always been ready to help whenever asked to do so. Frequent visits have been paid to the most suspicious localities and inspections made at frequent intervals.

In a number of instances I have been requested to visit ranches to examine individual cases which were considered suspicious by the owner, but have in most instances found the disease to be strangles or distemper in one of its various forms.

I would state here that the Island of Maui is a very large district for one veterinarian to look after and a great deal of time must necessarily be spent on the road; it is therefore not always possible to respond to a call without considerable delay, depending upon the distance which will have to be traveled. It should also be borne in mind that the salary of the Deputy Territorial Veterinarian amounts to only \$100 per month and that the expenses connected with the carrying out of the official work consumes a considerable portion of this salary. It is, therefore, strongly recommended that each plantation and ranch provide a quarantine pen, well isolated from all stables and yards, where affected or suspicious animals can be segregated and kept until the arrival of the veterinarian, and that these isolation pens should be utilized not alone for the stock belonging to the plantations or ranches, but also for outside stock which may be brought to the notice of lunas, foremen or police officials.

GLANDERS.

Glanders has been located in the following districts: Ulupalakua, Lahaina and Kailua, and from observations made and information furnished by the various owners, it would appear that the disease has been prevalent in these districts for a number of years.

The mallein test has been applied in a general way on both the Ulupalakua and Waiohuli ranches; all of the horse stock, both broken and unbroken, having been tested on these two places, in all about 150 head. Four cases of glanders were found and slaughtered and the usual precaution taken to prevent the further spread of the disease.

It is my intention to make a systematic campaign throughout the ranches of this island, using the mallein test whenever required.

In the Lahaina district one outbreak of glanders has occurred and one in the Kailua district.

CEREBRO SPINAL MENINGITIS.

At the request of the manager of the Wailuku Sugar Company, I attended their Waikapu stables to examine a mule which proved to be suffering from Cerebro Spinal Meningitis. This was the first of what proved to be quite a serious outbreak. In all six animals were affected in a short space of time, five dying and one making a complete recovery under treatment. Immediately afterwards three mules, the property of the Hawaiian Commercial & Sugar Company, stabled in the same locality, were stricken with this disease, two recovering after treatment. The stables were disinfected and whitewashed and the drinking water and food changed, with a view to preventing any further cases. This has proved successful so far, as up to the present time no more cases have occurred.

STRANGLES, DISTEMPER AND CATARRHAL FEVER.

This disease has been brought to my notice on several occasions, being mistaken in many cases by the owners as suspicious of glanders. By the history which has been gathered and observations made it would appear that this disease pays an annual visit to the ranches here, its ravages playing havoc with the working stock and reducing their general condition to such an extent that it is many weeks before they can be put to work again; although not proving fatal in the majority of cases, it is a great drawback to the general working of the ranches. It is my intention to investigate the next outbreak, with the idea of placing troughs in the pastures containing medicated molasses as was done in the treatment of Osteomalacia in cattle.

APPENDIX.

REPORT ON THE CULTIVATION OF RUBBER IN CEYLON AND THE FEDERATED MALAY STATES AND JOHORE.

BY FRED T. P. WATERHOUSE.

*To the Board of Agriculture and Forestry,
and Hawaiian Rubber Growers' Association,
Territory of Hawaii.*

Gentlemen:—I beg to submit the following report concerning my recent trip to Ceylon and the Malay Peninsula for the purpose of investigating and reporting upon the status of the Rubber Industry in those countries and the methods of planting, cultivation, tapping and treatment of rubber, in use there, with a view to giving the people of Hawaii information upon the said subjects.

The status of the Rubber Industry in Hawaii and the conditions under which I made this trip are as follows:

Ficus Elastica has for many years been a garden tree in Hawaii, but no attempt to make practical use of the same, has ever been made.

Some twelve or fourteen years ago the then Commissioner of Agriculture of the Republic of Hawaii, introduced and disseminated through the Islands a number of seeds of the Ceara Rubber tree. No especial notice was taken of the results until about five years ago when a tree, then seven or eight years of age, at Nahiku, Maui, was tapped and was found to yield an apparently good commercial article of rubber.

Upon further investigation a number of vigorous, healthy Ceara rubber trees were found to be growing in the various districts of the Islands.

Upon the showing made several companies for the cultivation of rubber were formed and a considerable number of trees planted.

In the month of December, 1907, there were growing in the District of Koolau, Island of Maui, approximately twelve hundred acres of Ceara rubber trees and a very few trees of the Hevea and Castiloea varieties.

In view of the possibilities of the rubber industry in this Territory; of the fact that Ceylon and the Malay Peninsula have engaged in the cultivation of rubber on a larger scale than any other part of the world and of the further fact that in Ceylon Ceara rubber had been profitably cultivated it was deemed advisable by some of the rubber growers of Hawaii, and by the Board of Agriculture and Forestry to send someone to that section of the world to make observations as to means and methods used there in connection with the industry, and to report thereon for the benefit of the industry and the public in Hawaii.

With this object in view it was decided, that as I was about to visit the Malay Peninsula in the interest of the firm I am connected with, that I should extend my proposed trip, the expenses being partially paid by those interested in the rubber industry in Hawaii and by the Board of Agriculture and Forestry.

In accordance with this purpose I was duly commissioned by the Board of Agriculture and Forestry, and left Honolulu on the 15th day of November, 1907, arriving at Singapore on the 16th day of December following.

From my arrival at Singapore until the 18th day of January I visited many of the principal rubber plantations in the Federated Malay States. Arriving at Colombo, Ceylon, on January 22nd, I spent ten days visiting plantations, sailing for Java on the 1st of February. Eight days were spent in Java and I arrived again at Singapore Sunday, February 23rd.

From then on to the time of my departure, February 29th, I spent on the plantations in the Province of Johore.

I am indebted to Dr. Willis, Director of the Royal Botanical Gardens at Peradeniya; Mr. Fox, Acting Director of the Singapore Botanical Gardens; Mr. Pit, at the Botanical Gardens at Buitenzorg, Java, and the different plantation managers and government officials that it was my pleasure to meet, for valuable information and courtesies.

The cultivation of rubber trees is being extensively carried on in Ceylon, the Federated Malay States, Borneo and Java. In these countries greater advance has been made in rubber cultivation than in any other part of the world. Virgin forests are being felled, cleared, replanted with rubber trees, and brought into bearing at a cost of from \$100 to \$150 (U. S. gold) per acre while commercial rubber is produced and placed on the London market at a cost of from 24 cents to 36 cents per pound including capital cost. The tapping of rubber trees and the method of collecting and handling the latex from the trees in a systematic and econom-

ical way is only in its infancy. As time goes on and large areas of trees come into bearing and with the experience gained, the cost of collection should be materially reduced. The problems yet to be solved are: How old or how large the trees should be before they are ready for tapping; how to reduce the amount of bark cutting without loss; how often and for what length of time it is best to rest the trees; whether to use the

Problems. single "V" method of cutting the bark, the herring bone or some other system. There are also the questions of whether or not it is best to cut the trees on both sides at the same time or alternately; the frequency of tapping and its effect on the quantity, richness and strength of the rubber; the number of trees most profitable to plant to the acre, etc., etc. I found a difference of opinion as to what tapping tools were best to use and the method of treating the latex. One question appears to be settled, however, and that is that

Variety Planted. in this part of the world the Hevea is the most satisfactory tree to plant and is being planted almost exclusively. It grows well, is hardy and will stand a great deal of abuse, while the cost of gathering the latex is less and the profit consequently greater with this variety than with any other.

The yield of rubber per acre per annum is also greater than with other varieties. Ceara is planted to a very small extent in parts of Ceylon on the higher elevations where Hevea does not do as well. Ficus Elastica was planted to quite an extent at one time but is now being abandoned or cut out. Castilloa does not do well as it grows very slowly.

HEVEA OR "PARA" RUBBER.

Hevea or "Para" rubber does best where the temperature does not go below 60°, but localities where the temperature does not go below 65° are preferred. The temperature in Malaya and Ceylon does not vary more than four degrees between the cooler and warmer months. The climate is very humid. January is the coolest month while March is the warmest. The following table shows the weather reports for the months of April, 1907, to March, 1908, inclusive. These readings were taken at Kuala Lumpor, State of Selangor, F. M. S., which is about the center of the largest plantings in Malaya.

1907	Mean Barometrical Pressure at 32 F	Maximum in sun	Temperature				Hygrometer.				Prevailing direction of Winds	Total Rainfall	Greatest Rainfall During 24 Hours
			Mean dry bulb	Maximum	Minimum	Range	Mean wet bulb	Vapour Tension	Dew Point	Humidity			
April .	29.814	145.3	81.0	91.1	71.6	19.5	76.5	0.832	73.7	78	Calm	12.69	2.48
May .	29.883	149.2	80.8	90.5	71.8	18.7	76.5	0.830	73.6	79	Calm	7.55	2.53
June .	29.883	147.6	80.3	90.0	71.1	18.8	76.1	0.819	73.2	78	S W	7.44	3.56
July .	29.872	147.1	80.5	90.4	71.3	19.1	76.3	0.825	73.4	79	S W	3.37	0.90
Aug .	29.884	150.8	80.9	90.3	70.6	19.7	76.2	0.818	73.0	77	S W	0.72	0.72
Sept .	29.822	147.8	80.7	90.7	70.9	19.8	76.5	0.833	73.7	79	S W	6.69	1.26
Oct .	29.874	141.3	79.4	89.5	70.7	18.8	76.0	0.840	73.6	83	S W	12.38	2.43
Nov .	29.881	149.8	80.3	89.3	71.1	18.2	75.8	0.810	72.9	78	S W	7.73	1.50
Dec .	29.877	137.0	78.9	89.3	70.2	19.1	75.8	0.828	73.7	84	S W	18.92	3.65
1908													
Jan .	29.875	147.2	80.9	90.5	71.1	19.4	76.6	0.839	73.8	79	N W	7.71	5.20
Feb .	29.883	149.6	80.8	90.1	70.6	19.5	75.6	0.807	72.9	77	Calm	14.01	3.00
March	29.880	143.9	80.2	89.8	70.8	19.0	76.8	0.820	73.5	79	S W	10.10	2.67

The rainfall in the countries visited is very great and well distributed over the year. Para seems to do best in districts where the rainfall is from 70 to 150 inches per annum. An *Rainfall*. experiment with irrigated Para trees is being carried on at the present time in Ceylon in a district where there is little rainfall and in a locality where the trees are exposed to the wind which tends to wither the leaves. Irrigated trees in dry districts would in all probability do well if they were protected from the wind. There are no strong winds in the rubber districts, the wind seldom exceeding a velocity of 20 miles an hour below the 3000 feet altitude. Flat low land was originally preferred for rubber plantations but rubber does equally well in rolling or hilly country. The elevation at which most of the rubber is planted is below 200 feet. The thirty year old Hevea trees at Peradeniya at an elevation of 1500 feet above the sea level, however, show an excellent growth. *Soil*. The soil in Malaya is alluvial and in some localities mixed with a moderate amount of sand. Photo No. 1 shows 15 months old Hevea growing on such soil. Sandy soil, however, is unsuitable while rocky soil is generally favorable. The following gives the analysis of some of the soil in Ceylon. I quote from Circular No. 6, Volume III, of the Royal Botanic Gardens, Ceylon, a copy of which was kindly furnished me by Dr. Willis:



No. 1. 15 months' old Hevea.

“CEYLON SOILS IN WHICH RUBBER IS PLANTED.

It is obvious that since Para rubber has been planted from sea level up to 2,000 feet in districts such as Galle, Baddegama, Kelani, Ambalangoda, Kalutara, Ratnapura, Polgahawela, Veyangoda, Kadugannawa, Peradeniya, Matale, Kurunegala, Badulla, and Passara, there must necessarily be considerable variation in the chemical and physical properties of the soils now under this product.

The land in rubber is, in the south of the Island, mainly flat; here and there steep rocky hillsides similar to what one sees up-country are planted in rubber, but one has to leave the south of the island and go to the Central and Uva Provinces in order to see large areas of rocky, hilly land planted with this product. In many districts the alluvial soils along the banks of rivers have been planted, in most cases below flood level, so that the conditions of the Amazon valley are to some extent imitated.

Experiments have been commenced in dry, but irrigable areas. The want of rain in proper proportions and quantities may prevent the extension of rubber in the northern part of the island, where only the northeast monsoon is felt and where the annual rainfall varies from 40 to 60 inches.

The soil types in which Para rubber is being cultivated may therefore be roughly divided into the following:

1. Cabook.
2. Alluvial soils.
3. Tea and cacao soils.
4. Swamps.

The cabook soils are met with as local areas in many districts. They are usually inferior from a chemical and physical standpoint, though in many cases the growth of the rubber trees appears to be satisfactory. Such soils usually show a small percentage of organic matter, potash, phosphoric acid and lime. A typical example shows the following composition:

ANALYSIS OF TYPICAL CABOOKY SOIL.

Mechanical Composition.

	Per Cent.
Fine soil passing 90 mesh.....	11.50
Fine soil passing 60 mesh.....	9.50
Medium soil passing 30 mesh.....	4.00
Coarse sand and small stones.....	75.00
	<hr/>
	100.00

Chemical Composition.

Moisture	3.300
Organic matter and combined water	8.000
Oxide of iron and manganese	7.400
Oxide of alumina	8.200
Lime	0.060
Magnesia	0.054
Potash	0.085
Phosphoric acid	0.010
Soda	0.074
Sulphuric acid	0.008
Chlorine	0.003
Sand and silicates	72.806

100.000

Containing nitrogen	0.128
Equal to ammonia	0.156
Lower oxide of iron	Trace
Acidity	Much
Citric soluble potash	0.006
Critic soluble phosphoric acid	Nil

Alluvial Soil.—For physical properties these soils are usually good, and the amount of sediment periodically deposited during floods adds considerably to the chemical richness of the soil.

They are largely composed of the lighter materials carried down in suspension by moving water. The particles are very fine, most of them passing a 60 mesh. The fineness of such soils partly depends on the speed of the moving water; the swifter the flow the coarser the particles.

The particles are arrested and precipitated all along the banks of the river during flood time. During heavy floods very large quantities of matter are often deposited along the banks, but they are often of a coarser nature due to the higher speed.

The particles which go to make up all alluvial soil may have been brought from considerable distances; they constitute the fine parts of soils liable to wash within the drainage area of the river. Attempts have been made in some countries to regain this suspended soil by the process called "warping," which is only practicable in the neighborhood of tidal estuaries. This is accomplished by letting the water run over the land, and then cutting it off from the main supply by sluices; after some time, by repeatedly going through this process, a soil is built up. This artificial alluvial soil is usually rich in organic matter and other plant food, but usually poor in soluble food such as potash.

An example of an alluvial soil is given below. The sample was taken from the banks of the Mahaweli-ganga at Peradeniya:

ANALYSIS OF ALLUVIAL SOIL, EXPERIMENT STATION, PERADENIYA.

Mechanical Composition.

	Per Cent.
Fine soil passing 90 mesh.....	53.90
Fine soil passing 60 mesh.....	43.00
Medium soil passing 30 mesh.....	3.00
Coarse sand and small stones.....	0.10
	<hr/>
	100.00

Chemical Composition.

Moisture	3.000
Organic matter and combined water.....	11.000
Oxide of iron and manganese.....	8.000
Oxide of alumina.....	9.717
Lime	0.130
Magnesia	0.259
Potash	0.162
Phosphoric acid	0.076
Soda	0.188
Sulphuric acid	0.054
Chlorine	0.014
Sand and silicates.....	67.400
	<hr/>
	100.000
Containing nitrogen	0.230
Equal to ammonia.....	0.280
Lower oxide of iron.....	Much
Acidity	Neutral
Citric soluble potash.....	0.013
Citric soluble phosphoric acid.....	Trace

The sample is a micaceous loamy deposit in a fine state of division with a fair retentive power of moisture. There is a fairly good supply of organic matter with a good supply of nitrogen. The acidity, as it is to be expected, from such a soil is nil. The mineral plant food is good in lime, magnesia, and potash, mainly derived from the mica, but is rather poor in phosphoric acid.

3. *Tea and Cacao Soils.*—On many estates the tea and cacao has been interplanted with rubber, and the variation in soil composition is very great.

The following analyses show the composition of tea and cacao land now planted with rubber, and the latter showing a good growth in the Peradeniya district:

ANALYSIS OF SOIL FROM TYPICAL CACAO LAND INTERPLANTED WITH
RUBBER.

No. 1.

Mechanical Composition.

	Per Cent.
Fine soil passing 90 mesh.....	48.00
Fine soil passing 60 mesh.....	42.00
Medium soil passing 30 mesh.....	8.00
Coarse sand and small stones.....	2.00
	<hr/>
	100.00

Chemical Composition.

Moisture	3.600
Organic matter and combined water.....	4.600
Oxide of iron and manganese.....	7.200
Oxide of alumina.....	6.786
Lime	0.160
Magnesia	0.216
Potash	0.077
Phosphoric acid	0.064
Soda	0.233
Sulphuric acid	0.048
Chlorine	0.016
Sand and silicates.....	77.000
	<hr/>
	100.000

Containing nitrogen	0.100
Equal to ammonia.....	0.122
Lower oxide of iron.....	Trace
Acidity	Fair
Citric soluble potash.....	0.008
Citric soluble phosphoric acid.....	Nil

ANALYSIS OF SOIL FROM TYPICAL TEA LAND INTERPLANTED WITH
RUBBER.

No. 1

Mechanical Composition.

	Per Cent.
Fine soil passing 90 mesh.....	34.00
Fine soil passing 60 mesh.....	25.00
Medium soil passing 30 mesh.....	10.00
Coarse sand and small stones.....	31.00
	<hr/>
	100.00

Chemical Composition.

Moisture	3.000
Organic matter and combined water	6.000
Oxide of iron and manganese	5.200
Oxide of alumina	13.049
Lime	0.160
Magnesia	0.490
Potash	0.401
Phosphoric acid	0.089
Soda	0.137
Sulphuric acid	0.068
Chlorine	0.006
Sand and silicates	71.400

100.000

Containing nitrogen	0.162
Equal to ammonia	0.195
Lower oxide of iron	Trace
Acidity	Much
Citric soluble potash	0.025
Citric soluble phosphoric acid	Trace

4. *Swamps*.—The cultivation of rubber in such areas has during the last year shown a considerable increase. Providing the draining and liming of the soils are efficiently carried out there seems no reason why continued satisfactory growth should not be obtained on such land.

The drainage should be very thorough so as to allow a good percolation of air and water through the otherwise sour soils.

In some cases each rubber tree should have a separate drainage system, the drains being two or more feet wide and 3 to 4 feet deep, the material from them being heaped up near the rubber tree. In other cases each line of rubber trees may be separately drained. When the drains are sufficiently large and the soil from them is heaped around the rubber, a dry soil is ultimately obtained, in areas which have hitherto been too swampy for any cultivation except paddy. The following analysis will show the general composition of such a soil:

ANALYSIS OF SWAMPY RUBBER SOIL FROM THE SOUTHERN PROVINCE (BLACK SOIL).

Mechanical Composition.

	Per Cent.
Fine soil passing 90 mesh	59.00
Fine soil passing 60 mesh	36.00
Medium soil passing 30 mesh	1.00
Coarse sand and small stones	4.00
	100.00

Chemical Composition.

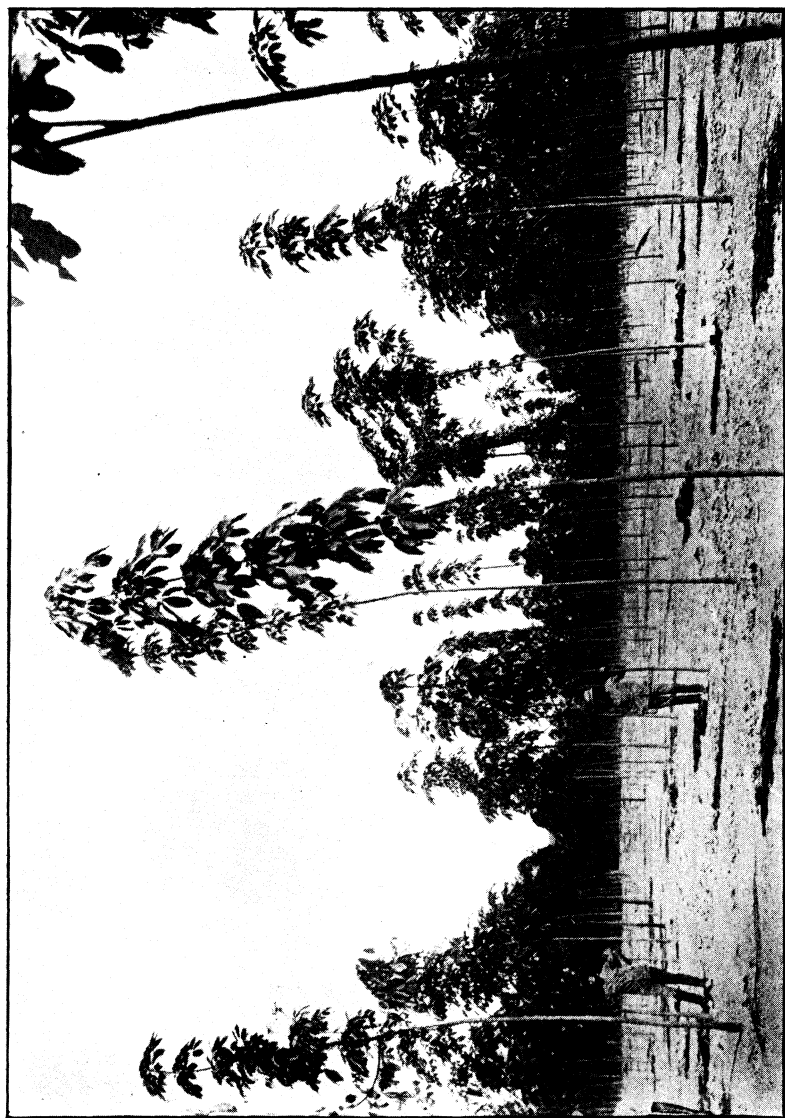
Moisture	5.600
Organic matter and combined water	20.400
Oxide of iron and manganese	1.200
Oxide of alumina	5.232
Lime	0.050
Magnesia	0.115
Potash	0.061
Phosphoric acid	0.064
Soda	0.182
Sulphuric	0.048
Chlorine	0.048
Sand and silicates	67.000
	<hr/>
	100.000

Containing nitrogen	0.448
Equal to ammonia	0.544
Lower oxide of iron	Much
Acidity	Much
Citric soluble potash	0.009
Citric soluble phosphoric acid	Nil

The above composition shows a chemical richness in organic matter and nitrogen which rarely obtains in low-country districts and strongly reminds one of the soils at high elevations in Ceylon. It is to be regretted that the area of such rich land in the low country is small, and the above analysis is certainly encouraging to planters who have swampy soils capable of being effectively drained and made sweet by the application of lime or by burning. To a certain extent the method to be adopted with such soils is similar to that for the peaty tracts of the Nuwara Eliya District."

In planting rubber, land is usually selectetd that is covered with virgin forest. The forest trees are felled and *Clearing.* allowed to lie on the ground until there is a dry spell, when they are burned off. Stumps are not removed, neither are the tree trunks that do not burn, but they are left on the ground to rot. After the burn, with the exception of the large timber and stumps, the land is perfectly clean and ready for planting.

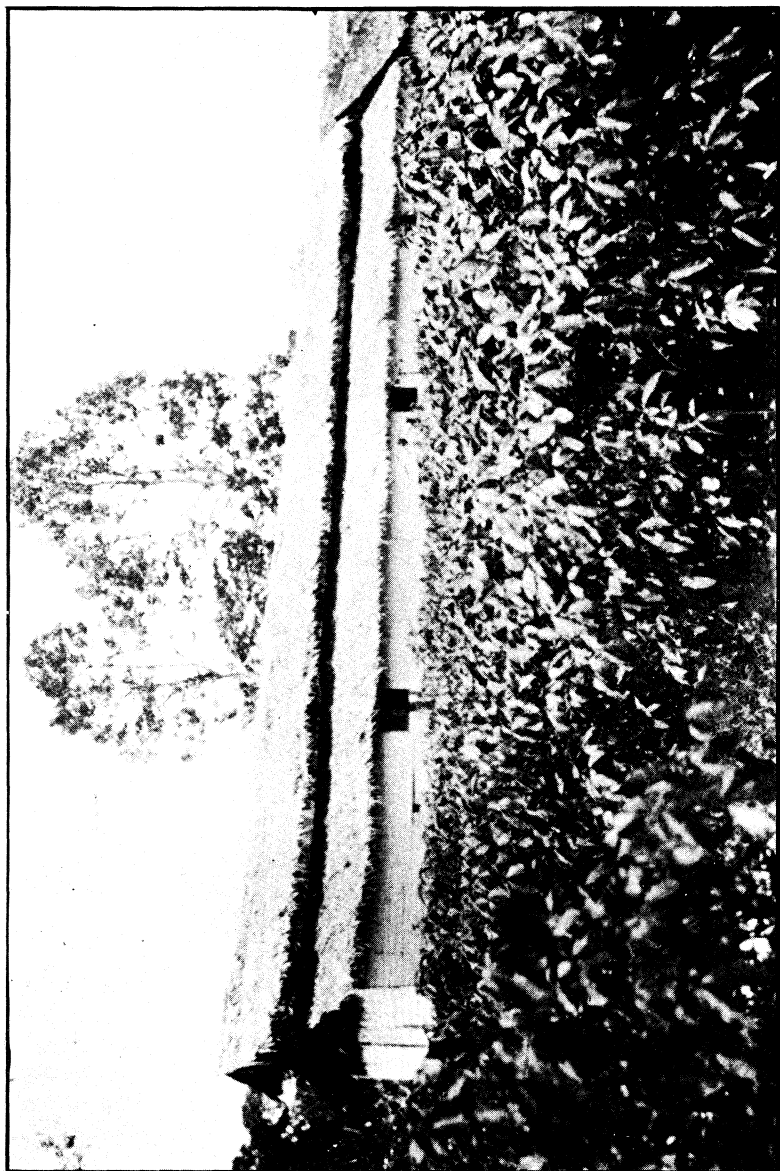
Some of the planting is done on fields that were formerly used for tapioca and also rice cultivation. After being *Lalang Grass.* abandoned by the planters of these crops the lands become overgrown with "Lalang" grass (*Imperata arundinacea*), one of the most troublesome weeds in



No. 2. Two year old Hevea. Distance 16x16—167 per acre.



No. 3. Three months' old nursery and laborers' quarters.



No. 4. Same nursery at five months. Plants were one foot high when one month old.

Malaya, which grows and spreads like our Hilo grass. Lalang is an oily grass and cattle will not eat it. Fortunately it will not grow in shade and consequently is easily kept out of rubber groves where the trees shade the ground nor does it grow in the jungle. The average cost of clearing an acre of lalang is about \$24.00 gold, which is more than it costs to fell and clear jungle forests. Photo No. 2 shows two year old *Hevea* growing on an old lalang field.

Planting is done from seed. The seed is oval in shape and about the size of an Ohia seed. The bulk of the seed
Planting. crop ripens in August and September, although the trees seed more or less all through the year. As the seed quickly loses its germinating power it is planted soon after ripening.

The planting of *Hevea* trees is done in different ways. Unquestionably trees planted "at stake" grow much quicker than trees planted in any other way and if the seeds were plentiful at all seasons of the year there probably would

Methods of Planting. be more planting "at stake." In Ceylon the method that is considered the best is to plant the seeds in woven palm leaf baskets about 8 inches in height and 4 inches in diameter and when the plants are about a foot high, plant baskets with trees in their permanent positions. This basket method comes nearest to planting at stake and there is minimum interruption in the growth of the young plants in setting them out. The more general method, however, in the far east is to plant seed in nurseries about six inches apart. Seventy-five to ninety per cent. of the seeds planted germinate.

Nurseries. The ground selected to be used as a nursery is carefully prepared. It is thoroughly dug up and weeds and roots removed and the soil pulverized by hand. The young plants are left in the nurseries for several months, until they are from 18 inches to two or three feet in height, when they are stumped, the tap roots cut, and the plants transplanted, removing as little soil from the roots as possible.

Transplanting has to be done when the weather is favorable and after the land has been cleared and burned.
Transplanting. As dry weather is necessary for a good burn, the time for transplanting varies and depends on weather conditions. The young trees are planted in rows but the distance between the trees and between the rows varies a great deal on different plantations. There is a difference of opinion on this point, but it is generally considered to be a fact that planting closer than 200 trees per acre is a failure.

A great deal of the planting at the present time is in avenues.

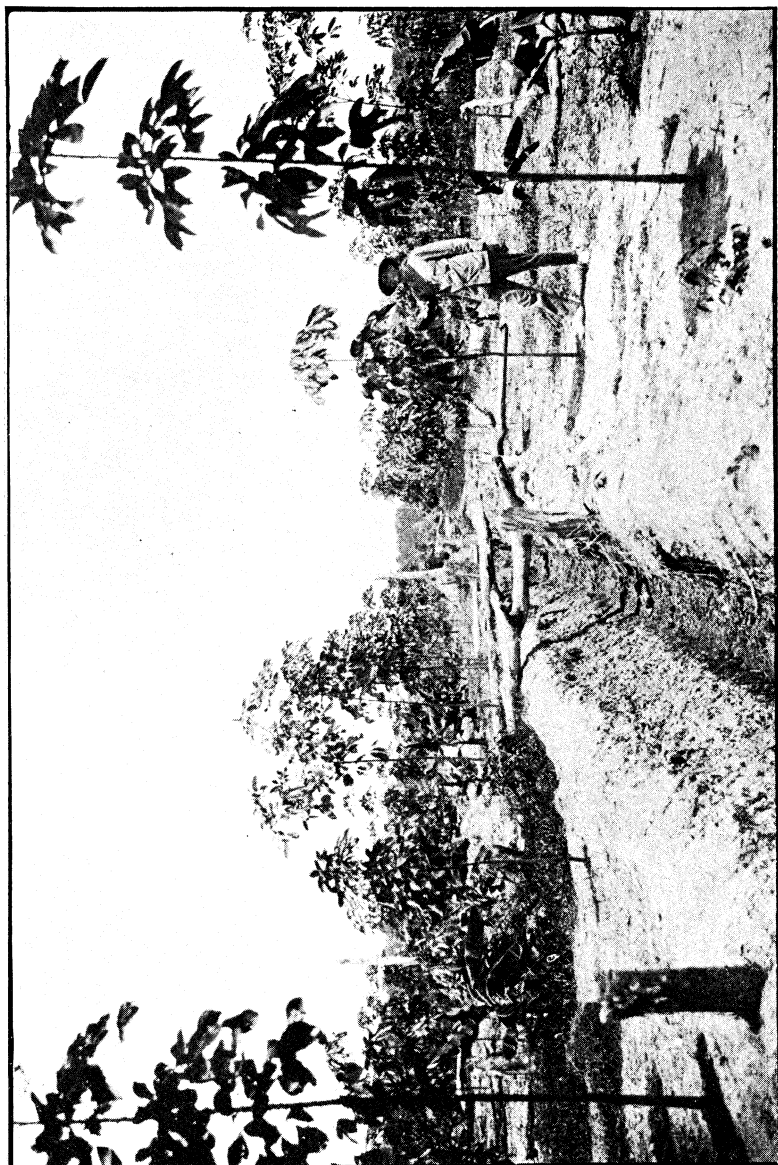
In Ceylon most planting now being done *Planting in Avenues.* is in avenues twenty feet wide, the trees being fifteen feet apart. They are planted so that the avenues run east and west. This gives the sun a chance to shine on the soil. In Malaya most planting is now being done 12 by 24 or 148 to the acre. Some planting is being done 15 by 30 or 96 per acre. One plantation I visited was planting in equilateral triangles, the trees being $17\frac{1}{2}$ feet apart or 160 per acre, as against planting in rectangles $17\frac{1}{2} \times 17\frac{1}{2}$, which would give only 140 per acre.

Most plantations weed clean. This is very expensive and there are some plantations that weed only in rows while *Weeding.* others weed still less. I saw on one of the best paying estates, a field of two year old trees growing in a lalang patch where they had had only weeded the lalang around each tree. These trees were doing very well. On a great many plantations the weeds are easily cleaned out after the burn and by keeping them down at first the expense of weeding is not great. Such land cannot be compared with our land where we have Hilo grass to contend with. In Ceylon the older men prefer clean weeding, but green manuring is coming in vogue rapidly.

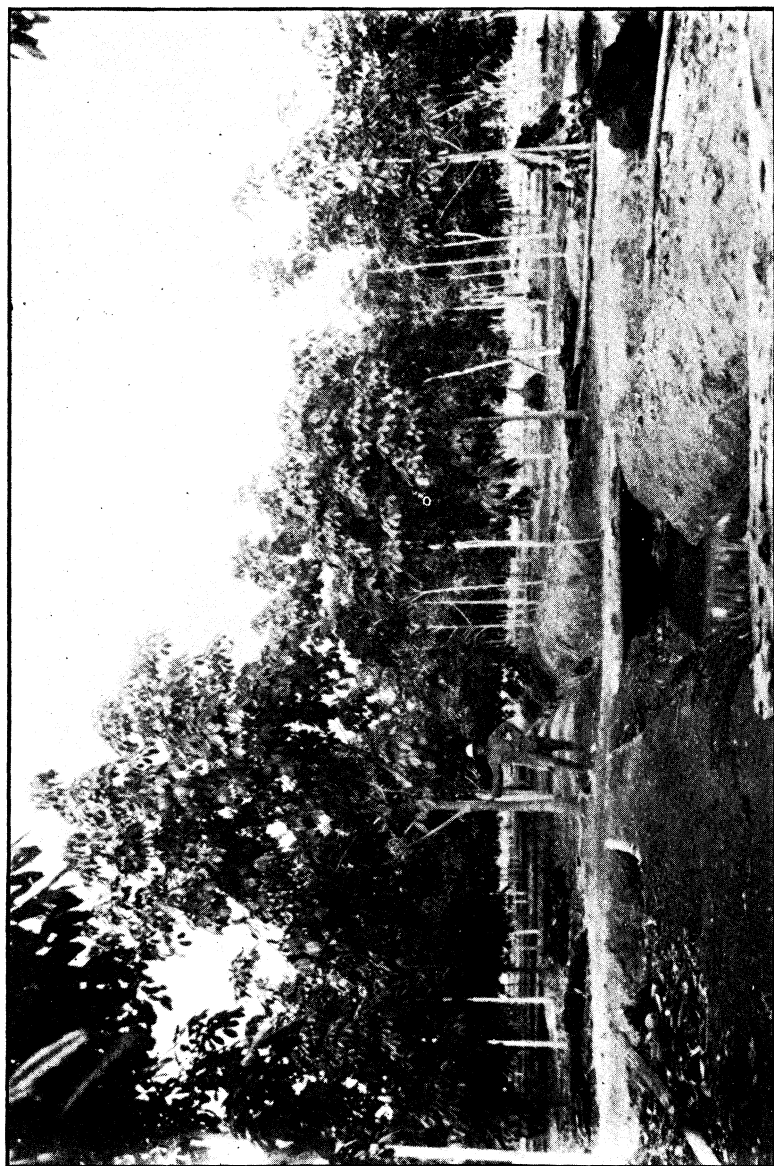
In places where the land is low and swampy it is drained so that there will be no standing water around the trees. *Draining.* Where the trees are planted on the hill sides drains are dug at intervals to prevent the water carrying away the top soil.

There is no cultivation as a rule beyond hoeing the weeds as the soil does not pack and consequently does not *Cultivating.* need to be loosened. Photo No. 6 shows trees two years and seven months old, planted in a field which was "chunkeled" (hoed) to a depth of from six to nine inches before being planted. The trees show a more than average growth, several of the trees being 20 inches in circumference three feet from the ground. This photo also shows how the land is drained.

Hevea grows in two forms, one more bushy than the other. Planters in Ceylon and Malaya prefer a tree fairly branched. There is a great deal of thumb nail pruning to make the trees branch at the height desired. This also has a tendency to make the tree large at the base. If a tree branches at 10 or 15 feet from the ground it is about right. Planters who have "topped" their trees state that it results in two large branches forming which is apt to split the trunk where the two branches meet, if the wind is strong. The more leaf area a tree has the better and the quicker will the "bark respond." Photos Nos. 7 and 8 show Hevea trees that have had plenty of room in which to grow and have branched naturally, while Photo No. 9 shows trees that have been prevented



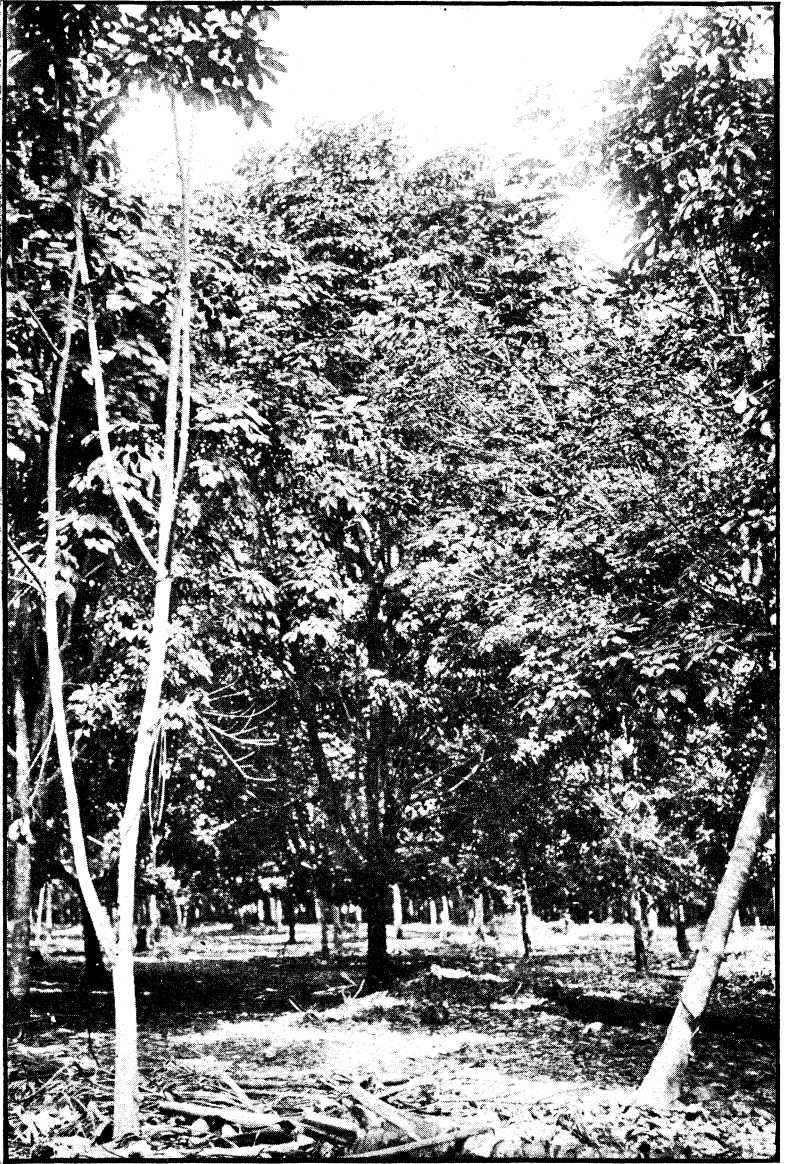
No. 5. One year old trees and drain.



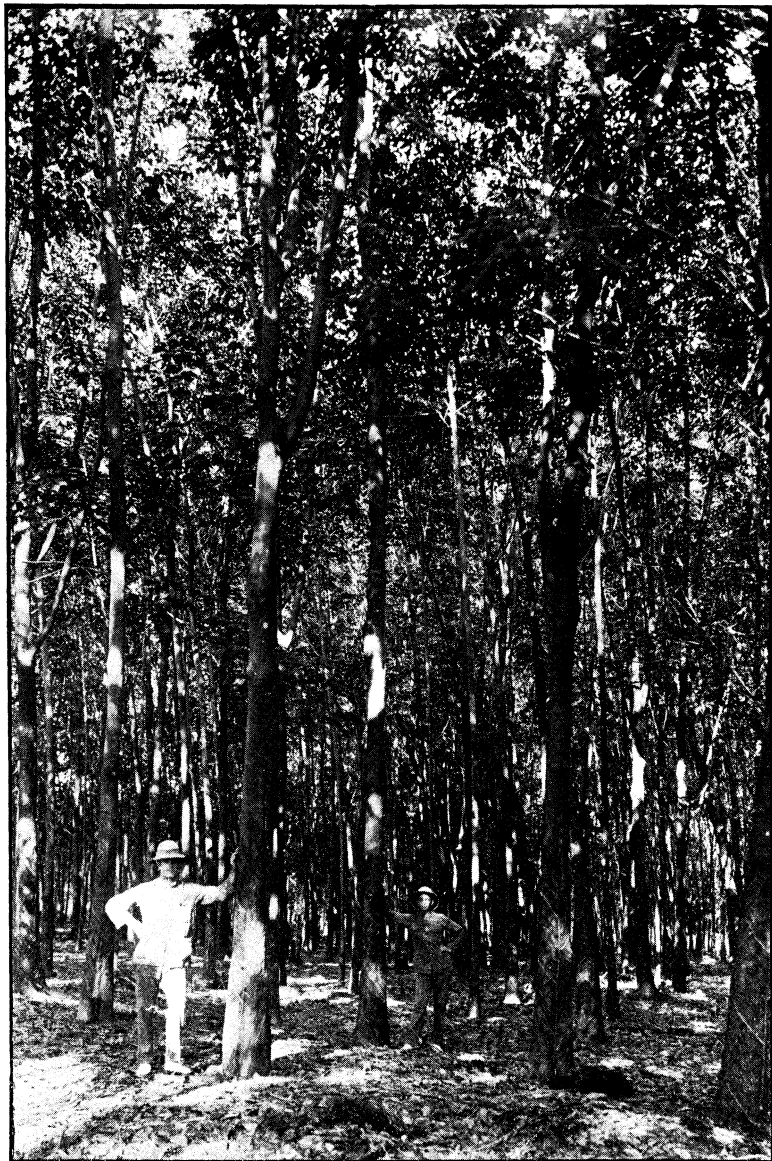
No. 6. *Hevea* planted 12x24—148 per acre. Age 2 yrs. and 7 mos. Large tree 20½ inches circumference.



No. 7. Eleven year old Hevea planted 24x24—74 per acre. Branches 15 feet from the ground.



No. 8. Seven and one half year old Hevea. Same tree as Photo No. 14.



No. 9. Eleven year old Hevea planted 10x10—435 per acre.

from branching by being planted too close together. The question of how close or how far apart the trees should be planted is one that has had a great deal of attention and is one of vital importance.

In considering the problem of how many trees it is best to plant to the acre, it is necessary to consider conditions as they are likely to exist in the future. In *How Close to Plant*, planting rubber for profit, it is the percentage of profit on the capital invested which determines its value as an investment rather than the gross earnings or profit per tree or per acre, or the total output of the plantation.

If we let

- A. Represent the acreage planted.
- X. Represent the number of trees per acre.
- T. Represent number of times a tree is tapped per year.
- C. Represent capital invested.
- N. Represent the number of trees per day one man can tap.
- y. Represent yield per tree per day's cutting.
- p. Represent price per pound of rubber.
- L. Represent days wage per laborer.
- E. Represent expenses (other than labor).

Then the market value of the rubber collected from one tree at a single tapping, less the cost of collecting same in laborers' time, multiplied by the total number of tappings per year on all the trees, less general expenses other than labor, will be the total profit for the year. Dividing this by the capital invested will give the percentage of profit on the investment or;

$$\text{Percentage of profit on capital invested} = \frac{A \times X \times T \left(py - \frac{L}{n} \right) - E}{C}$$

In this equation the value of X varies directly as C and inversely as y. The more trees planted to the acre or the larger X is the smaller the yield y will be and also the larger the capital to be invested, C. Then again the more py exceeds $\frac{L}{n}$ the greater will be the profit. Experience must determine what effect increasing N has upon the value of p and y; hence to arrive at the number of trees per acre that it is best to plant in order to try and obtain a maximum value of the percentage of profit on the capital invested we must consider:

- C. Capital invested.
- L. Cost of labor when trees come into bearing and also what it will be in the next ten and twenty years.
- p. Market price of rubber in five, ten and more years.
- y. Yield per tree at each single tapping.

T. Number of times per year it is best to tap each tree to get the best results.

n. Number of trees per day one man will be able to tap.

Some planters think it will be more profitable to plant for a period of ten or fifteen years only while others have confidence in the future beyond that time.

If trees are planted too close together they grow tall and have small leaf area and under these conditions the bark does not grow quickly as on trees planted wider apart.

Effect of Close Planting. Neither does the new bark form and grow over the tapped surface as quickly as in wider planting and it is now found necessary to rest a too

closely planted forest, while continuous tapping can be made on wider plantings. Photo No. 10 shows trees that were planted too thickly with the result that the usual tapping area having been cut the renewed bark is too thin to tap so that experiments are being made in tapping up to 12 feet high. The trees are usually considered large enough to be tapped when they are twenty inches in circumference three feet from the ground, but one grove that I saw that was planted 10x10 or 436 to the acre, although large enough in circumference when five years old, the bark was found to be too thin to tap. On another plantation they were tapping two groves of the same age, 8½ years, one planted 12x24 or 148 per acre (see Photo No. 11), and the other 12x12 or 296 per acre. The 12x24 trees gave an average yield of 3 pounds per tree while the 12x12 trees averaged a little less than 1¾ pounds and gave less on second tapping, thus acre for acre, the yield was about the same. The yield of rubber from each tree for each day's tapping was almost double from the trees in the 12x24 planting as compared with the 12x12 planting and as each coolie makes 80 tappings per day in either grove the cost of collecting a pound of rubber is nearly double in the grove more thickly planted.

Photo No. 7 is a grove planted 11 years ago 24x24 or 74 per acre. In talking with the gentleman who planted these trees he stated that if he were planting for himself he

Widest Planting. would plant at least 24x24 (74 per acre), and perhaps 30x30 (46 per acre). That he would

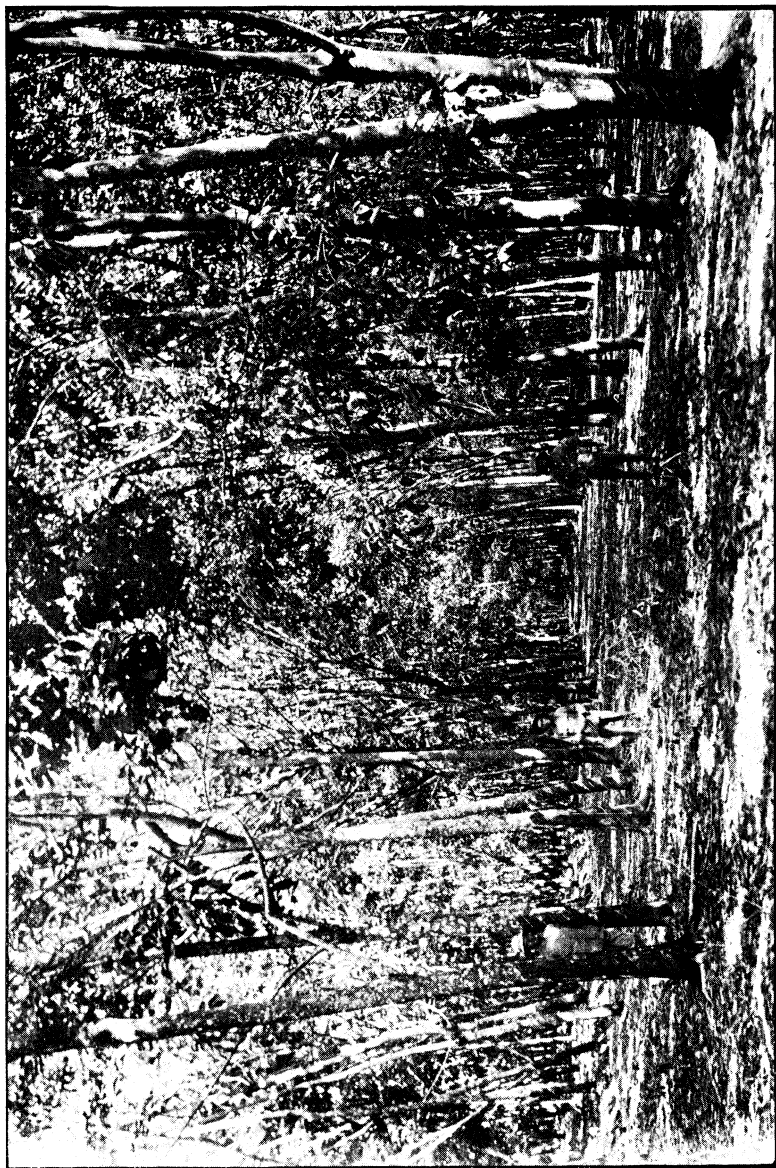
do this with the idea of making good profit twenty years from now as well as in the earlier years. Photo No. 12 shows eleven year old trees planted 60 to the acre. Eight hundred trees in this planting averaged a yield for the year of seven pounds or 420 pounds of rubber per acre.

Trees in Malaya usually attain a circumference of 20 inches three feet from the ground in from four to five years.

Growth. In Ceylon a few trees will reach this size in five to six years, many in six to seven years, and are tapped at the base when they measure twenty inches.



No. 10. Tapping twelve feet high. Eleven year old trees.



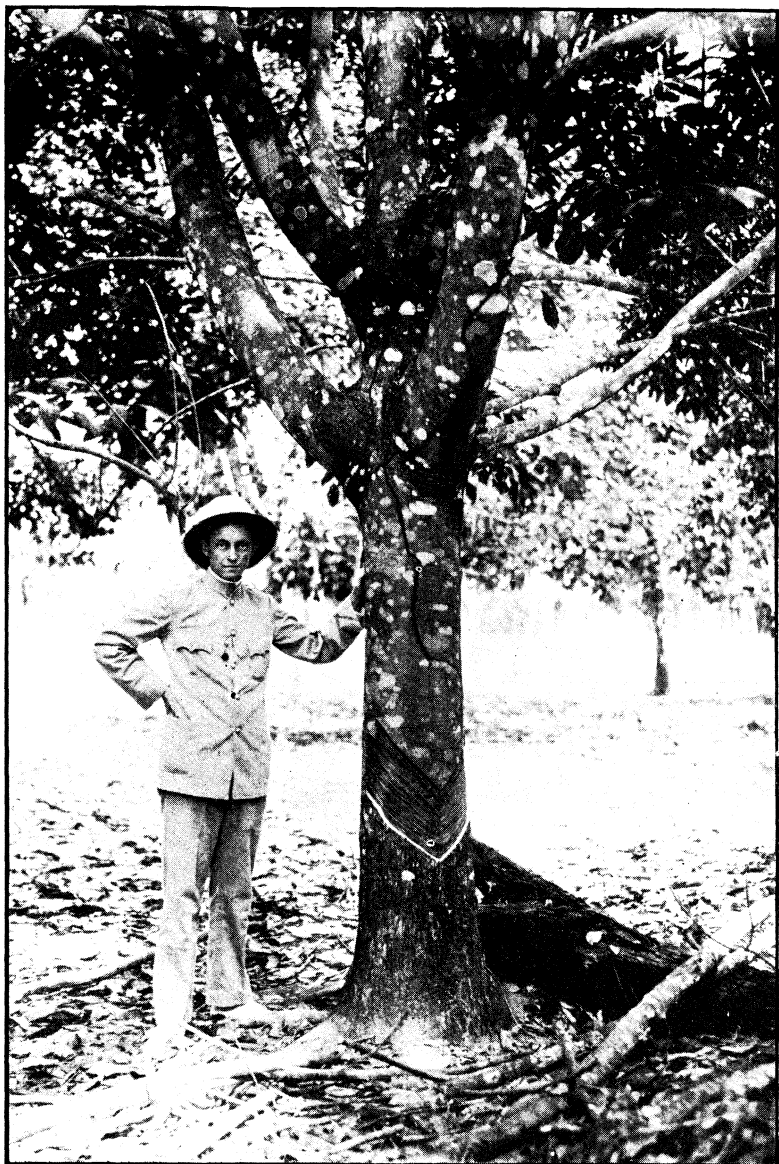
No. 11. $8\frac{1}{2}$ year old Hevea planted 12×24 —148 per acre.



No. 12. Eleven year old Hevea planted 60 per acre. Average yield 7 pounds per tree.



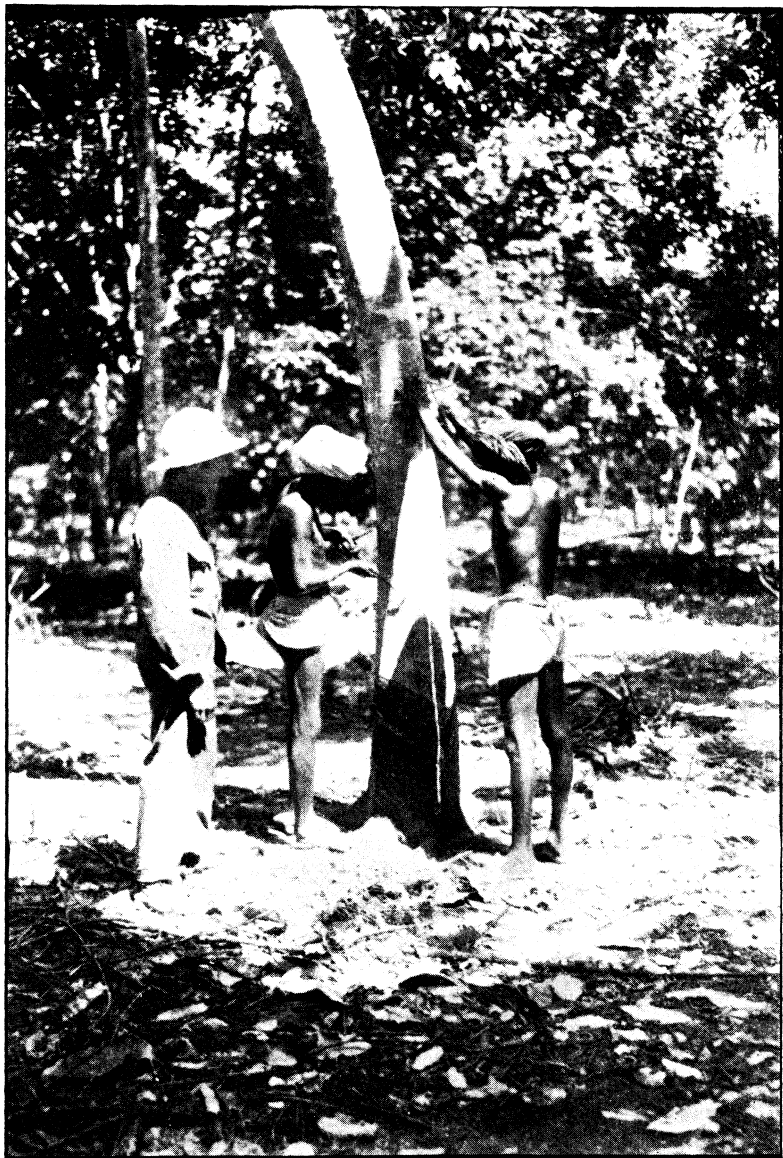
No. 13. Herringbone system of tapping.



No. 14. Single "V" tapping. $7\frac{1}{2}$ year old tree; same tree as Photo. No. 8. Planted 30x30.



No. 15. Tapping tree in grove planted 12x24—148 per acre.



No. 16. Marking Hevea tree before tapping.

Hevea is usually tapped every second or third day with rests every dry season. Some estates tap as above for 15 *Tapping.* tappings and then rest the trees from three to five months. For instance they will tap an area one day and another the next day. If the trees are planted wide enough apart this can be kept up indefinitely, tapping each tree from 30 to 45 times a year. Tapping is usually done in the morning before the heat of the day. Some of the larger plantations tap all day or until two o'clock. The flow is better in the early morning. To tap, a farrier's knife, a carpenter's gouge or some special tapping tool, is used to cut the bark. A lateral cut in the bark is made, care being taken not to cut through the cambium; it is made in such a way that the latex runs down in a groove until it reaches a tin or aluminum cup which is placed at the foot of the tree. See Photo No. 13.

There are a number of ways in which the cuts are made, the simplest being a "V" as in Photo No. 14.

The system as shown in Photo No. 13 is called the herringbone system. There are a number of modifications of this system such as the half herringbone system shown in Photo No. 10, in which the lateral cuts are all made to run into a vertical cut. Some times the slanting cuts will go half way round the tree, one side of the tree being tapped this way until all the bark has been cut and then the other half is tapped, the lateral cuts running into the vertical cut on the opposite side of the tree. Sometimes both sides of the tree will be tapped by this system at the same time, as in Photo No. 10, a cup being placed on either side of the tree under the vertical cut. Again two sides of the tree will be tapped at the same time on the half herringbone system with the lateral cuts only extending a quarter of the way round the tree, so that the two sections on opposite sides of the tree will be tapped at the same time, while the intervening sections will not be tapped until all the bark has been cut on the first sections.

Photo No. 16 shows the coolies marking a tree on that portion of the bark that has not been tapped at all. The space between the cuts is measured and a light cut made just deep enough to show the tapping coolie where to tap. Each time a tree is tapped a little mark is made on it so that there is a record kept as to how many times a tree has been tapped.

In the grove shown in Photo No. 11, where the average yield is 3 pounds per tree, the half herringbone system of tapping was being used on both sides of the tree, the laterals going quarter of the way round only. Each tree was tapped every other day for 15 tappings, and then the trees were rested for three months, so that during the year 45 cuts were made on each side of the tree.

A day's work for the tapping coolie was to tap 40 trees on both sides, thus setting out 80 cups to catch the latex. *Day's Work.* The coolie's work was not completed until he had picked up the thin strips of bark which were cut in tapping bringing them, together with 80 cups of latex, to the drying room. He then, after pouring the latex into a large container, must rinse the cups with water, saving the diluted latex thus obtained so that it would not be lost. He then washes the cups which completes his day's work. Women and children tap as well as men. The aluminum cups each hold about a half pint. A little water is put in each cup when it is set out so as to dilute the latex and prevent it from coagulating before it can be brought to the drying room. The amount of latex in each cup of course varies with the yield of the tree. Some trees filling the cups full.

The bark shavings that are brought in are put through the scrap machine which consists of rollers which grind the bark into a fine powder. *Scrap Rubber.* The larger portion of the bark is separated from the scrap rubber after it comes out of the rollers, and then the rubber, and whatever bark that has not been separated, is put through a second set of rollers on which streams of water are playing. This washes the remaining bark from the scrap and the rubber is turned back into the rollers over and over again until it is in the form of crépe rubber. It is then hung up to dry with the other rubber. The latex when it is brought in is strained and set out in pans as milk is set to cream and in three or four days the rubber coagulates in blocks about the size of half of a kerosene oil tin.

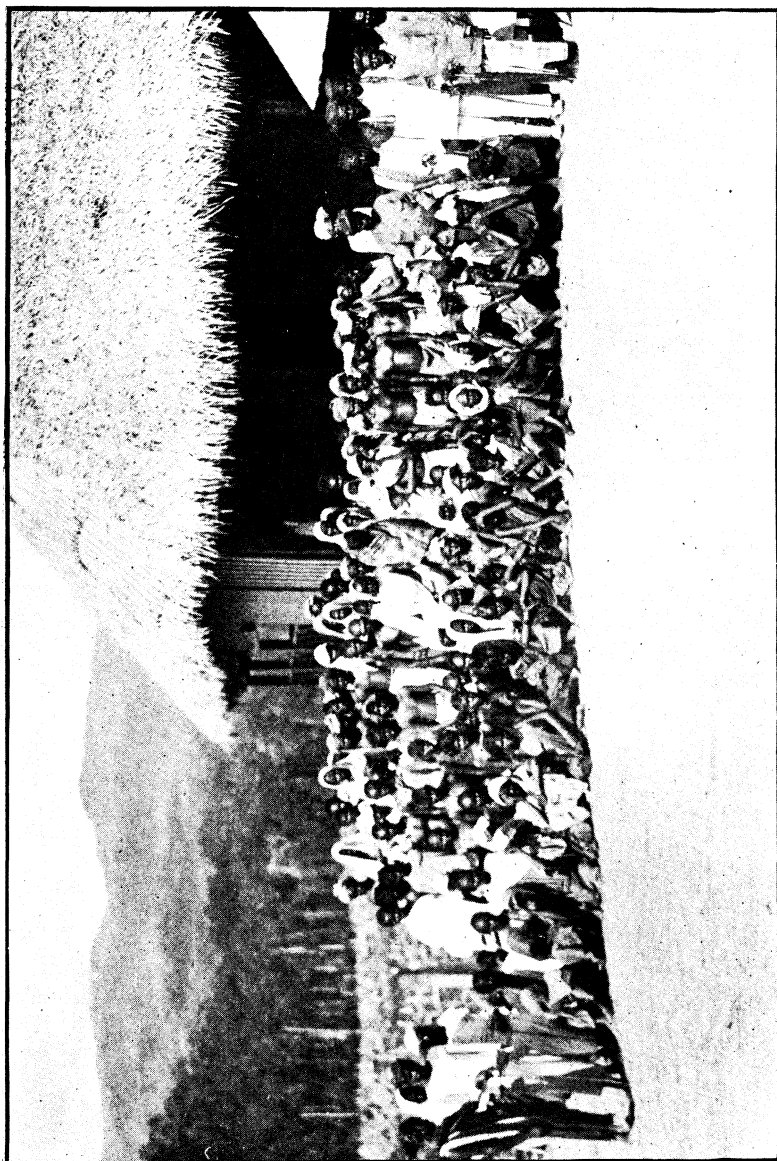
On several plantations they were using kerosene oil tins cut in half so that the two opposite sides of the tin would be the bottoms of the coagulating pans. Most plantations mix a little acid with the latex before it is set out in the coagulating pans to aid coagulation. The block of coagulated rubber is sometimes rolled into sheets and sold as sheet rubber, but oftener it is put through rollers under pressure on which streams of water are playing until it is ground into the form of crépe rubber. On one or two plantations the crépe or sheet rubber is compressed into blocks. The drying room or house is very often made of corrugated iron, or at least the roof is corrugated iron, and the rubber is hung up to dry as shown in Photo No. 17.

Some plantations use a vacuum dryer for drying the rubber.

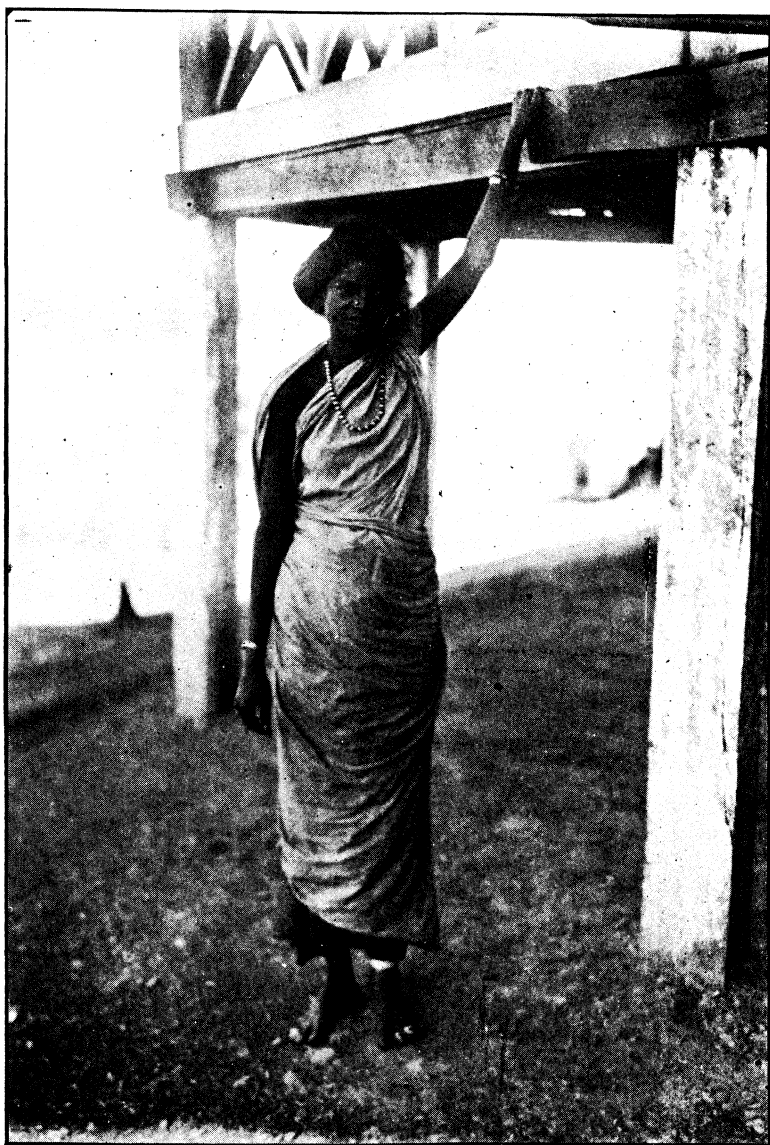
As there are so many methods of tapping employed on the different plantations, it is hard to say which system will eventually be perfected. I found, however, that where the single "V" system was used the amount of rubber collected per day for each coolie tapping and collecting was almost double that of plantations where they were using other systems in which five times as much bark was cut per tree.



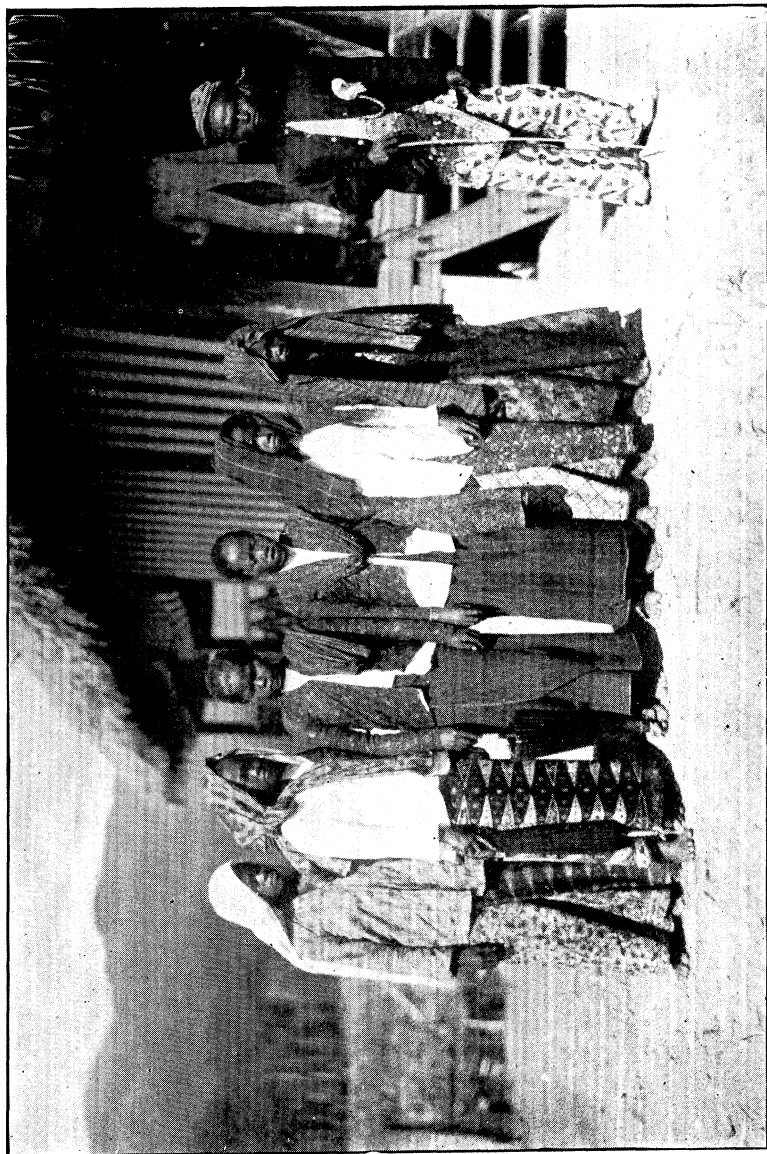
No. 17, Drying and Packing Room.



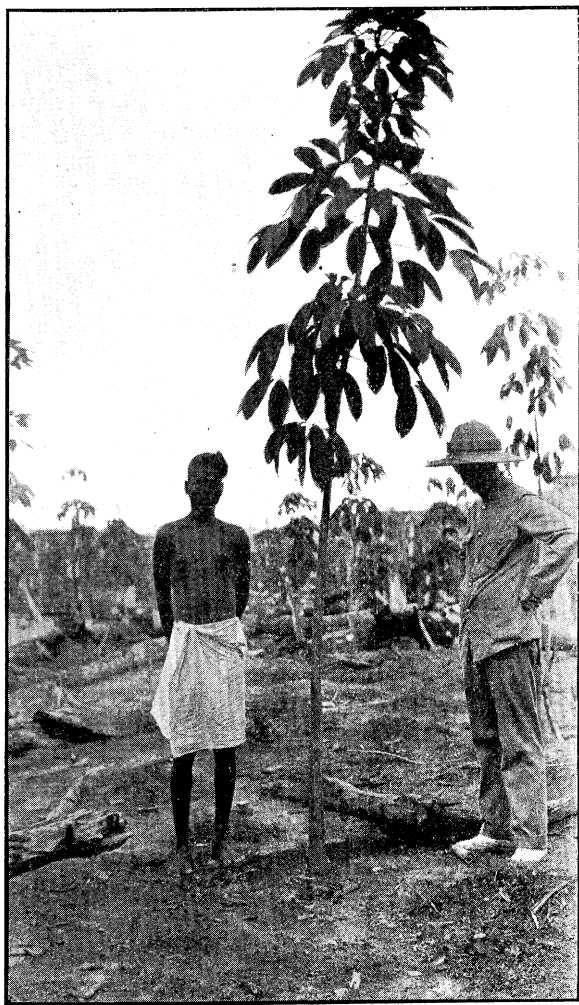
No. 18. Tamil Coolies.



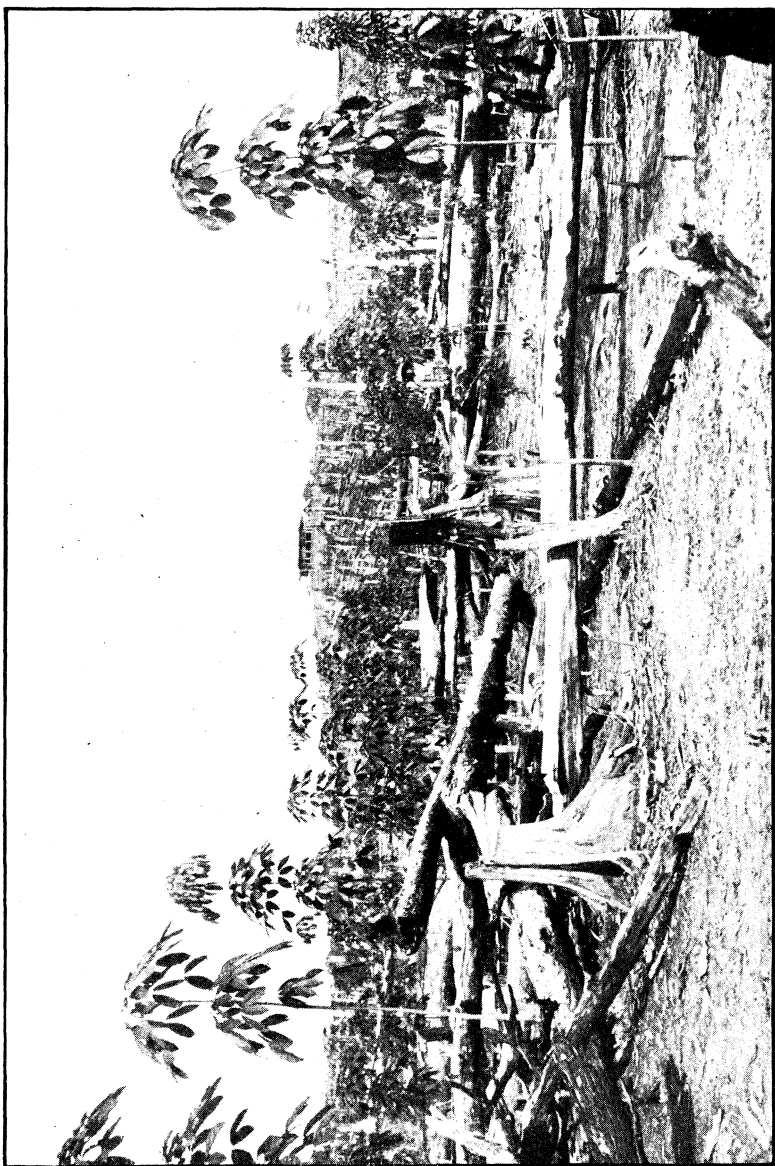
No. 19. Tamil Girl.



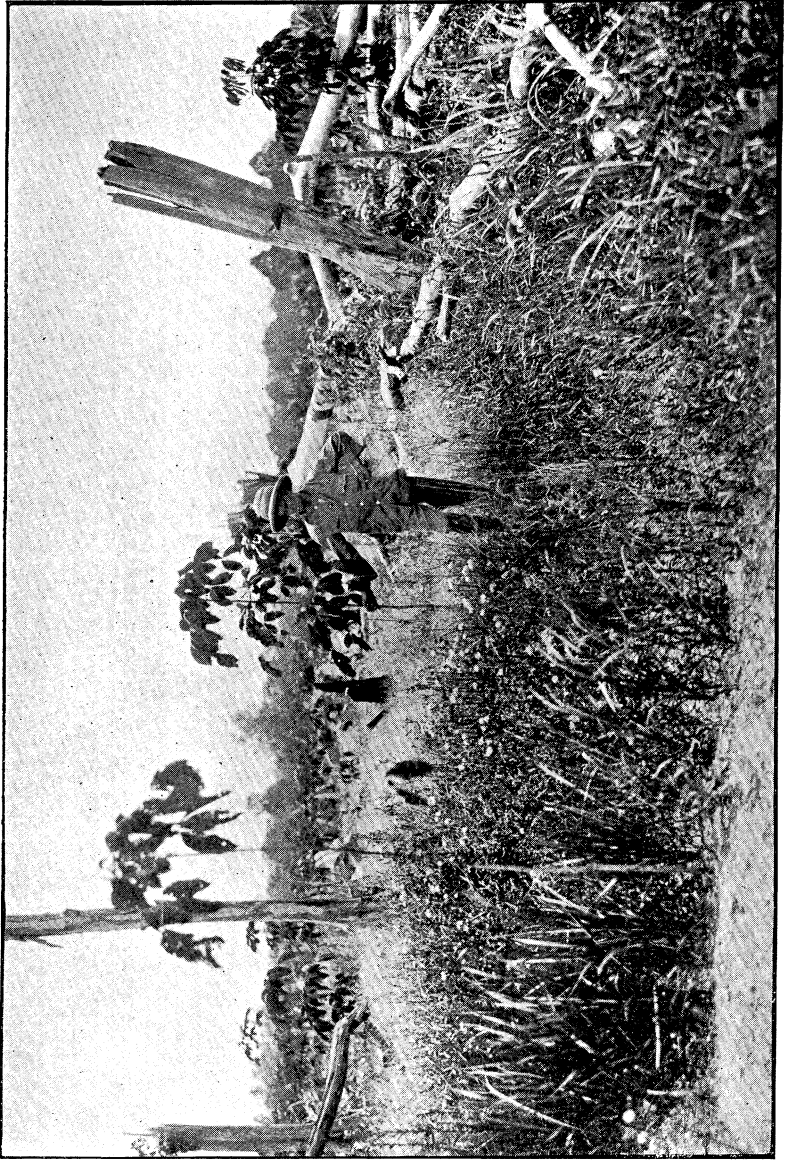
No. 20. Javanese Women and Mandor (luna).



No. 21. 14 months' old Hevea and Tamil Coolie.



No. 22. 14 months' old trees.



No. 23. 8 months' old tree. Average size of trees in 50 acre planting. Hand indicates growth since transplanting. Stumped and transplanted from 8 months' old nursery.

Coolies get about 37 rupe cents per day in Ceylon or 12 cents U. S. gold. In Malaya about 30 to 35 cents Straits *Labor*. Currency or 18 to 20 cents U. S. gold, and they work about 24 days, of 8 to 10 hours each, per month. Most of the coolies are Tamils, Javanese coming next in number, while the native Malays are employed principally in felling and clearing forests and in digging drains by contract. In Ceylon out of 450,000 laborers employed in different industries, 400,000 come from India. The Tamil coolies do not expend very much on clothing and a great many of them manage to save money to remit to India. They are not a muscular people, having very slender arms and legs, but they can carry a greater weight on their heads than they are capable of lifting. In tapping rubber trees, the Tamils are very good as they are very quick and it is not hard work. The Javanese are good workers and also good at tapping. The women work in the fields as well as the men, but do not get as large wages.

The output of a rubber plantation depends on the average age of the trees tapped. As the trees grow older the output will increase, but to what extent remains to be proved by experience. The output of one plantation in 1906 of 134,285 pounds increased in 1907 to 193,506 pounds from 84,278 trees tapped during that year or an average of over two pounds per tree.

Their largest trees are 11 years old, but two-thirds of them were under six years old.

This plantation was using the half herringbone system of tapping, the laterals going half way round the tree to the verticle cut on one side while the vertical cut on the opposite side drains the lateral cuts from the other side of the tree. On the new trees that are coming into bearing they are using the single "V." A tapping is made every other day on some of the trees and every third day on others for a period of six weeks when the trees are rested for six months. There is an average of one tapping coolie to three acres and a carpenter's gouge is used for a tapping tool.

CEARA RUBBER.

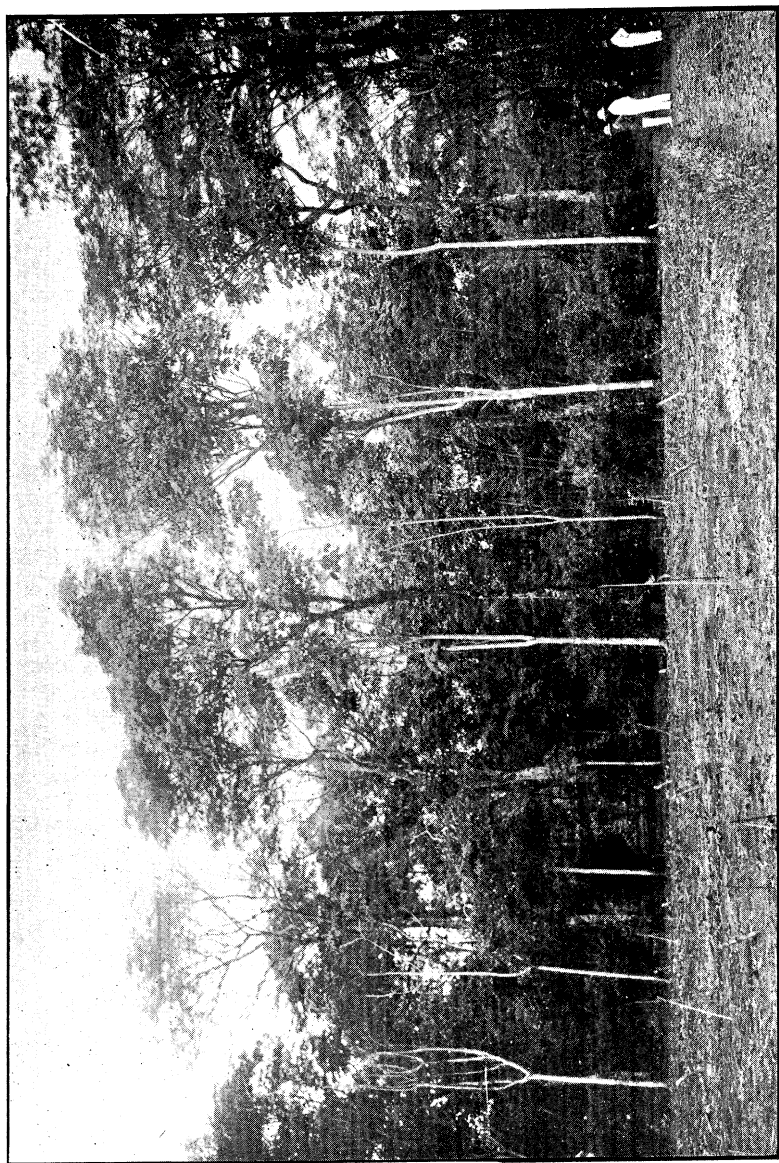
Most of the remarks in reference to Hevea apply also to Ceara with some important exceptions.

Twenty-three years ago Ceara was planted as shade for tea plants, but on account of inexperience in tapping and as the Ceara trees were not satisfactory as shade, they were, unfortunately, nearly all cut out. Ceara rubber trees can be planted and will grow well at higher elevations than Hevea. Most of the Ceara trees I examined were growing at an altitude of from 500 to 3,000 feet above sea level. Ceara can be planted where the temperature

goes as low as 45 degrees, but a temperature above 50 degrees is preferred. As to rainfall, Ceara does best where there is 50 to 120 inches of rain per annum. The best Ceara I saw was in a district where the rainfall is only sixty inches per annum. The trees will grow in rainier districts, however, but tapping is not so successful as in drier districts. Photo No. 24 shows some Ceara trees growing in the Botanical Gardens at Buitenzorg in Java, where experiments in Hevea rubber tapping are being carried on very carefully. The rainfall at the garden is 180 inches per annum. The Ceara trees shown in the picture are 8 years old and though they grow tall, the largest is only 24 inches in circumference three feet from the ground, while the others are much smaller.

On arriving in Ceylon, I found that there was only one estate on which there were Ceara trees being tapped to any extent and the output on this estate amounted to only 4,000 pounds of rubber per year.

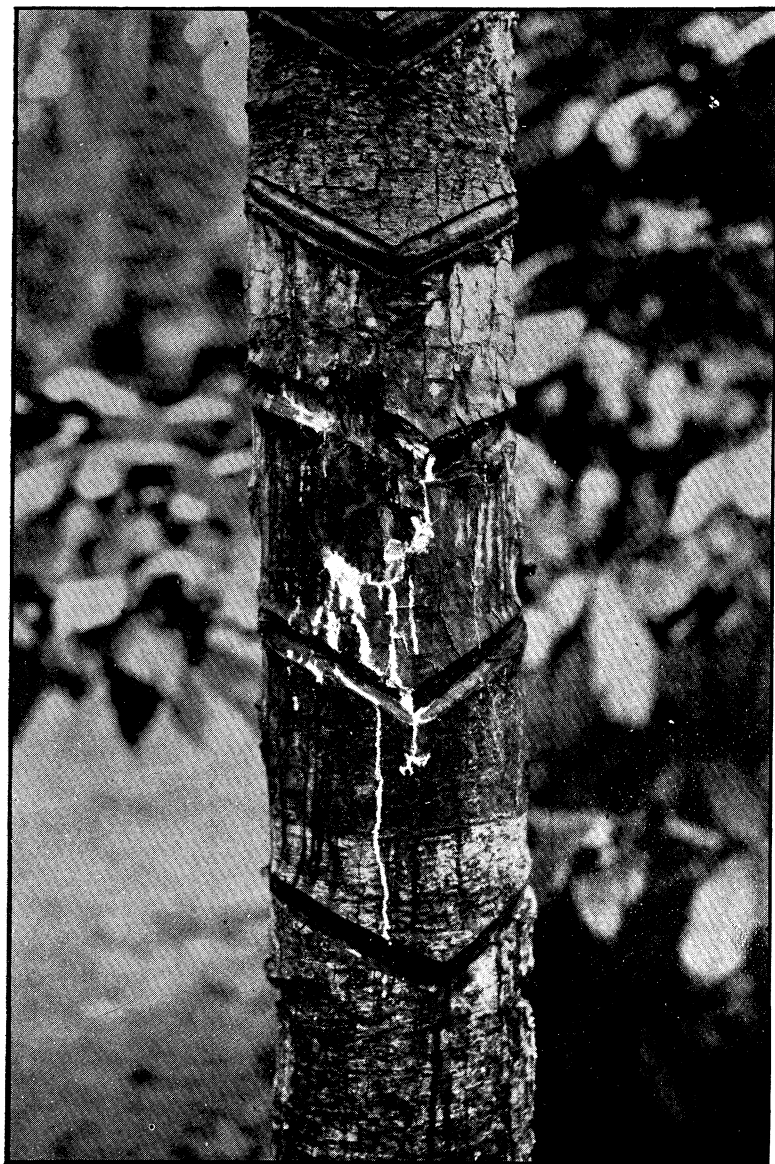
The main planting on the estate was Cacao, Cocanut and Ceara Rubber trees being planted for shade. No new Ceara rubber trees are being planted out, but from the young trees that spring up the best only are allowed to grow while the poorer ones are cut out. As a rule these trees are 20 inches in circumference three feet from the ground when they are three years old and are then old enough to be tapped profitably. The manager thinks that the yield is greater when the trees shed their leaves. The growth of these young trees varies a great deal and trees that get a start when the weather is showery in the morning and sunny in the afternoon grow quicker than those that sprout when the weather is too rainy and is cold at night. An ordinary curved pruning knife is used in tapping on this plantation. The bark is cut through the cambium to the wood, removing a piece of bark an eighth of an inch wide. "V" cuts are made one above the other a span apart but no vertical cut is made, the latex being allowed to flow over the bark. The manager claims that they get less scrap rubber in this way. The tree is tapped until an inch of wood is exposed. Photos Nos. 26 and 27 illustrate this method of tapping. The other side of the tree is tapped in the same way and then the tree left until the bark grows over. There is not the "wound response" in the Ceara that there is in the bark of the Hevea tree so that in tapping by this method an eighth of an inch of bark is removed each time the wound is reopened in order to get a good flow. With the Hevea it is only necessary to reopen the wound and the thinner the shaving the better. On account of the "wound response" the flow of latex increases as the tapplings proceed up to a certain point. This is not the case with the Ceara which is more apt to be the other way.



No. 24. Ceara trees at Buitenzorg, Java, 8 years old.



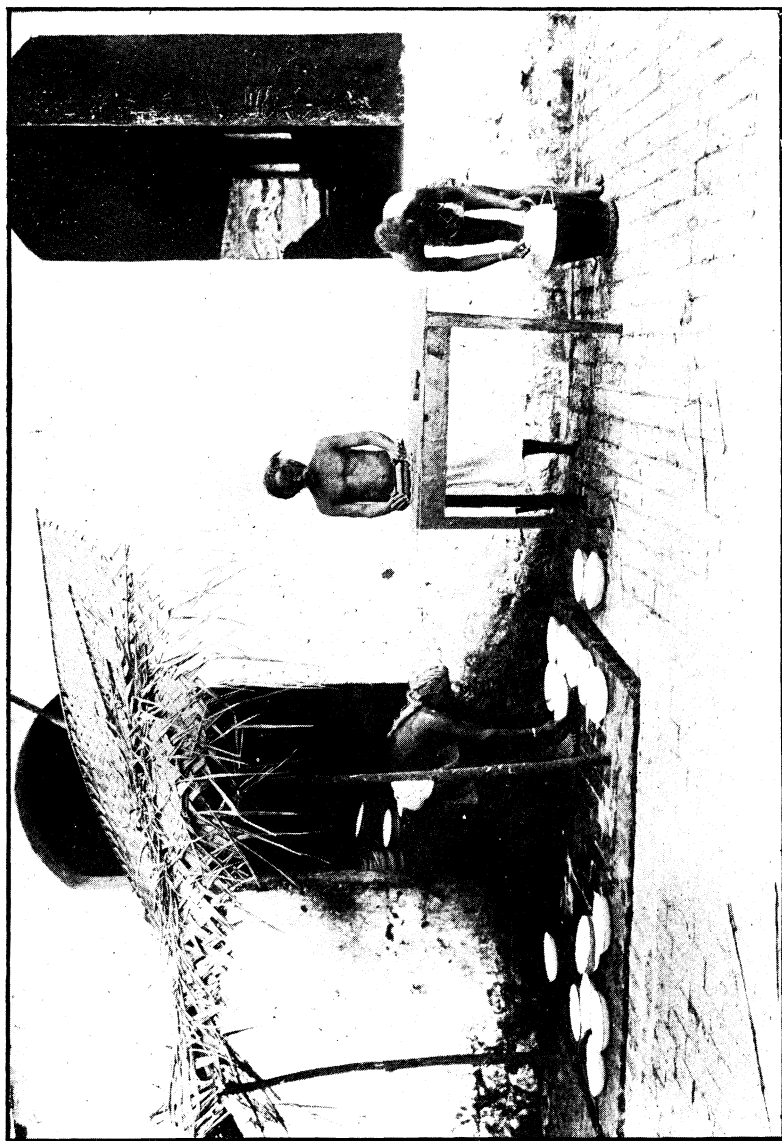
No. 25. Cocoa Plantation with Cecoamnt and Ceara Rubber Trees planted between the Cocoa.



No. 26. Tapping Ceara. Age of tree 4 or 5 years. Circumference 3 feet from the ground 28 inches.



No. 27. Same tree as Photo. No. 26.



No. 28. Making Ceara Rubber "Biscuits."



No. 29. 20 year old Ceara tree, showing method of tapping.

It will be noticed in Photo No. 26 that a round patch of the bark has rotted and will eventually come off. This is due to wet weather immediately after tapping, the water having soaked in between the bark and wood. When the bark comes off in this way the shot hole borer attacks the tree, weakening it, and it is likely to blow over when there is a strong wind. Experience has been that in the more rainy districts of Ceylon tapping has been unsuccessful, killing a great many of the trees.

The bark of the Ceara rubber tree is thinner than the Hevea and has a tendency to tear if the tapping knife is not sharp. This makes it harder to tap the Ceara when the same methods of tapping are used. It is considered more satisfactory on this plantation to tap as they do rather than use more careful methods as the young trees grow up so quickly that as soon as one tree dies there is another ready to be tapped in its place. A coolie taps the trees, sets out the cups and brings in the latex, setting it out in the pans to coagulate and rolls it into biscuits the next day. This constitutes a day's work for a coolie, if he brings in enough latex to make half a pound of dry rubber.

The rubber biscuit, after being rolled and washed, is spread on cocoanut leaves in the drying room and usually takes about three weeks to dry. As a coolie is paid the equivalent of 12 cents gold per day, it will be seen that the labor of collecting and making the biscuits costs 24 cents per pound. The latex on this plantation is coagulated by being mixed with water. Water coagulates Ceara latex very quickly. This fact makes it more desirable and more profitable to tap Ceara trees in dry weather as the rain coagulates the latex on the tree, making a bigger percentage of scrap. Ceara latex differs in this respect from the latex of the Hevea tree. Where water is used to delay coagulation of the latex from the Hevea tree, it has the effect of hastening coagulation with Ceara latex. This makes it more difficult to handle the Ceara latex than Hevea.

On some of the tea plantations that I visited where they have a few Ceara trees remaining, they are more careful in tapping and use the herringbone method, cutting only a little way into the bark and using a pricker. See Photo No. 29.

The trees are scattered and a day's work for a tapping coolie on these plantations is a third of a pound per day of dry rubber. Here the rainfall is large and more care has to be taken in tapping to preserve the trees.

I visited one plantation where they had a grove of 250 Ceara trees. This was at an elevation of 3000 feet and where the annual rainfall was from 120 to 150 inches. This is the highest elevation at which I saw rubber growing. Twenty-three years ago on this plantation, Ceara rubber was planted as shade for the tea, but later it was all cut out with the exception

of a belt of 450 trees. These trees in the last few years have been tapped, but since tapping commenced 250 of them have died as the result of the tapping. It is considered unsafe at the present time to take more than 250 pounds of dry rubber per year from these 200 trees. Three coolies work on the trees from September to the end of March. The largest tree is 49 inches in circumference, 3 feet from the ground and the tapping system is a series of "Vs" draining into a vertical cut.

A weak solution of ammonia (2% to 5%) is used to prevent coagulation caused by water in the collecting cups, or from coagulation by churning while being carried from the trees to the coagulating rooms.

This plantation gets 4s. and 2d. a pound for their Ceara when Islands Fine (wild) Para brings 3s. and 4d., but 10 pounds of the latter equals 8 pounds of cultivated on account of its having a smaller percentage of moisture, so that prices are really equal. It gets a little better price than plantation Para.

At present they are tapping over renewed bark without finding it necessary to remove any outer bark. The manager here thinks that if the same methods of tapping were used and the trees tapped first when young, that it would not be necessary to remove the outer bark as it would not have time to get too thick. They tap the trees every third day for 7 months, except in rainy weather, cutting a shaving a sixteenth to an eighth of an inch in thickness. The cut is shallow not reaching the cambian, but a pricker is used to augment the flow. As the trees are old trees, the outer bark that was removed was quite thick.

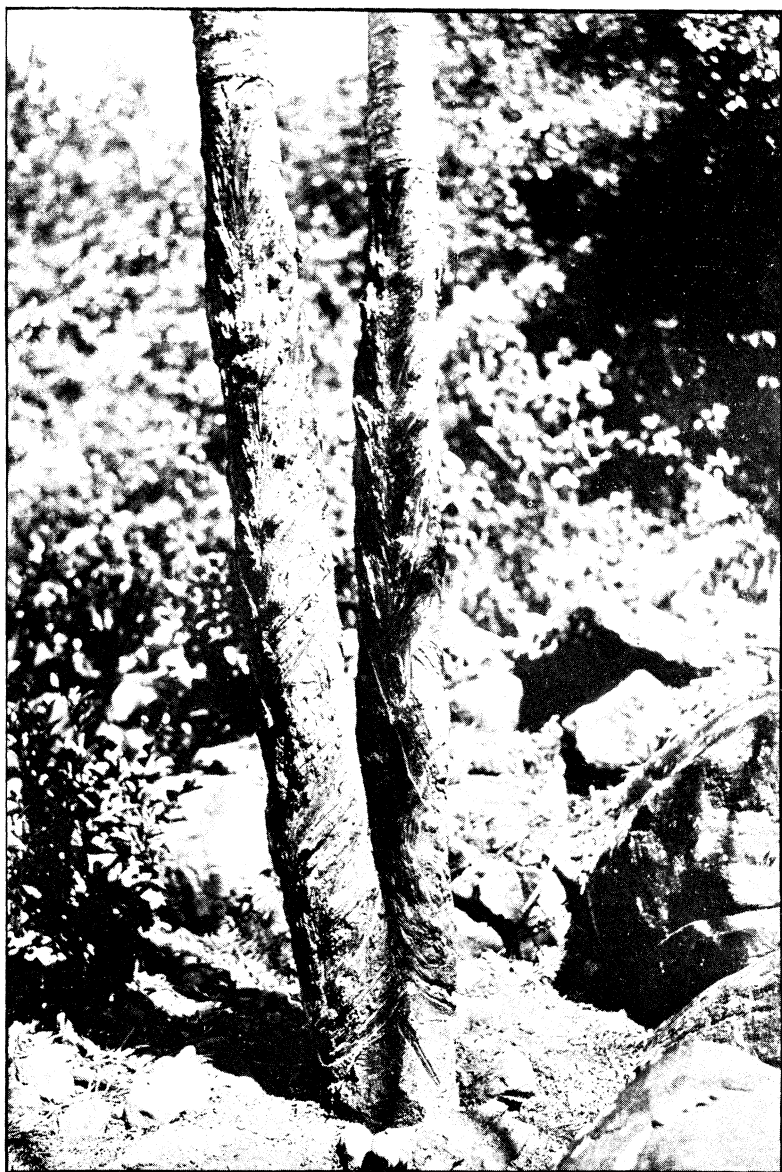
In conclusion I beg to submit the following general facts, conclusions and opinions concerning the rubber industry which I gathered during and in connection with my trip, which I hope may be of value to those interested in rubber production in Hawaii:

The present rubber production of the world is approximately seventy thousand tons.

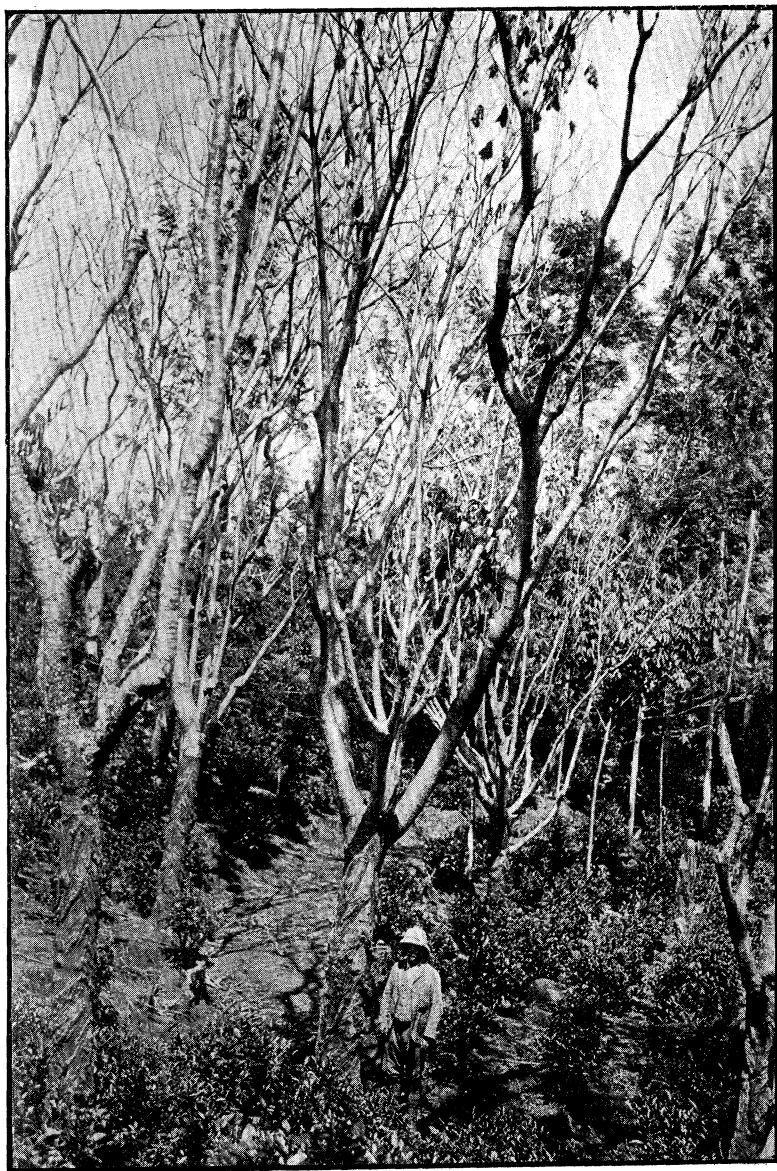
The great source of rubber is the forests of Brazil, which produced 41,000 tons in 1907.

The cultivation of rubber is now going on in nearly all the tropical countries of the world, it being most largely engaged in in Mexico, Central America, India, the Malay Peninsula, Ceylon and Java.

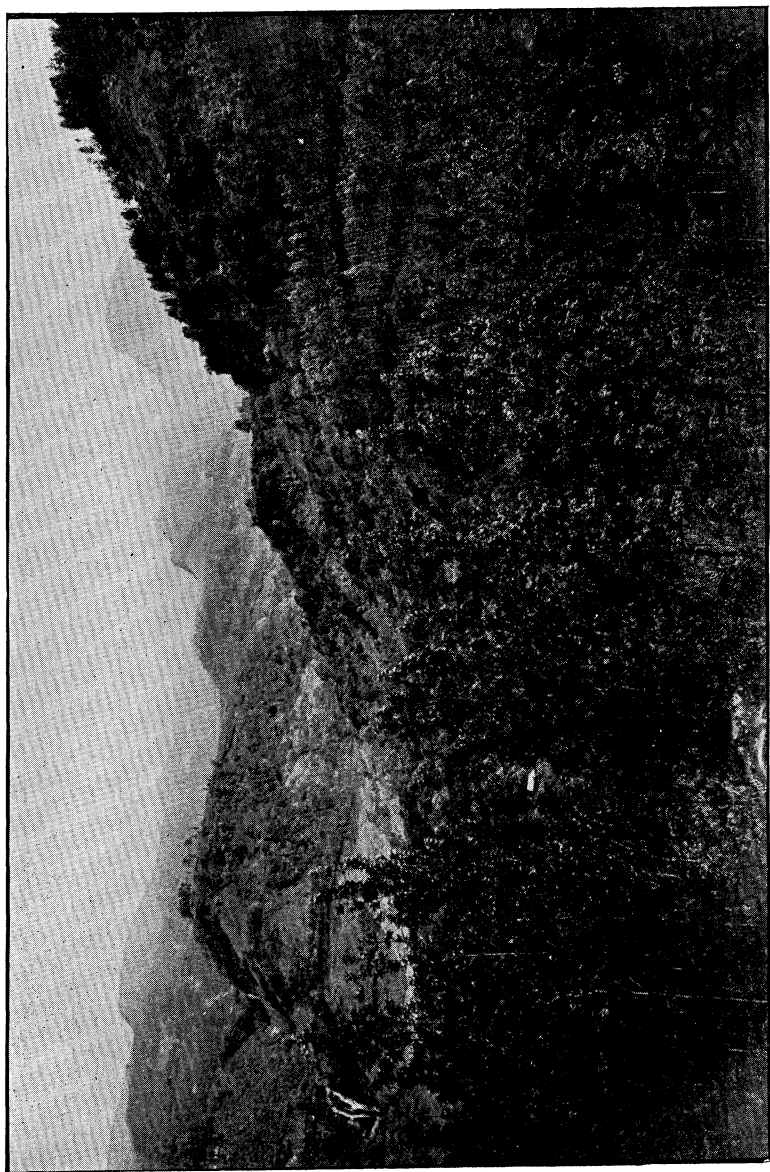
It is difficult to ascertain the exact area under cultivation, which is large, but the adaptability of different localities to rubber production has yet to be determined. It is certain that a very large proportion of the areas planted are unfitted for rubber cultivation or the wrong varieties of rubber trees have been planted. There is little danger of the rubber market being overstocked for some years to come from either wild or cultivated sources.



No. 30. Tapping Ceara tree on renewed bark. Rangbodde estate.



No. 31. 23 year old Ceara rubber growing between tea plants. Circumference 49 inches, 3 feet from ground.



No. 32. Tea Estate, Rangbodde, Ceylon. Elevation 3,000 feet.

Although a large area of cultivated rubber has been planted out, the production of the cultivated article has only just begun, as is evidenced by the fact that the output of cultivated rubber from Ceylon and Malaya for 1907 was only approximately 1,178 English tons.

The unknown quantity in Hawaii is the labor question. Tapping requires in Ceylon and Malaya a man for every one to four acres, according to the number of trees planted per acre and the convenience of location of the same.

The price of labor will also be a vital feature. In Ceylon and Malaya the laborer receives from twelve to thirty cents gold per day, while in Hawaii we are obliged to pay seventy-five cents to a dollar per day.

As to the relative efficiency of the labor in the far east and that of the ordinary laborer in Hawaii I am of the opinion that for the work in collecting rubber, our labor is as efficient and will accomplish more, as under local conditions twenty to twenty-five per cent. more time will constitute a day's work.

The Ceara tree will grow much quicker than the Hevea tree, but on the other hand, Hevea will yield more abundantly and the cost of collecting the latex will be less. Comparatively little attention has been given to the methods of collecting rubber from the Ceara variety of rubber trees as there are but a few dollars invested to thousands of dollars invested in Hevea plantings. Tapping experiments should be made as soon as possible on our Ceara plantings in order that more may be known before our trees come into bearing. There is still much to be learned through the experience of others in various rubber producing sections of the world, but, after all, we must very largely work out our own methods and learn for ourselves how best to meet our own problems, although the experience of others will always be of benefit.

Hoping that the facts and figures given in this report will be of benefit to the rubber producers of Hawaii, I have the honor to remain,

Your obedient servant,

FRED. T. P. WATERHOUSE.

PUBLICATIONS FOR DISTRIBUTION.

Any one or all of the publications listed below (except those marked *) will be sent to residents of this Territory, free, upon application to Mailing Clerk, P. O. Box 331, Honolulu.

BOARD.

Report of the Commissioner of Agriculture and Forestry for 1900; 66 pp.

Report of the Commissioner of Agriculture and Forestry for 1902; 88 pp.

* First Report of the Board of Commissioners of Agriculture and Forestry, from July 1, 1903, to December 31, 1904; 170 pp.

Second Report of the Board of Commissioners of Agriculture and Forestry, for the year ending December 31, 1905; 240 pp.; 8 plates; 10 text figures.

Third Report of the Board of Commissioners of Agriculture and Forestry, for the year ending December 31, 1906; 212 pp.; 3 plates; 4 maps; 7 text figures.

Fourth Report of the Board of Commissioners of Agriculture and Forestry, for the calendar year ending December 31, 1907; 202 pp.; 7 plates.

Fifth Report of the Board of Commissioners of Agriculture and Forestry, for the calendar year ending December 31, 1908; 213 pp.; 34 plates.

"Notice to Importers," by H. E. Cooper; 4 p.; 1903.

"Digest of the Statutes Relating to Importation, Soils, Plants, Fruits, Vegetables etc., into the Territory of Hawaii." General Circular No. 1; 6 pp.

"Important Notice to Ship Owners, Fruit Importers and Others. Rules and Regulations Prohibiting the Introduction of Certain Pests and Animals into the Territory of Hawaii." General Circular No. 2; 3 pp.; 1904.

"Law and Regulations, Importation and Inspection of Honey Bees and Honey." General Circular No. 3; 7 pp.; 1908.

"The Hawaiian Forester and Agriculturist," a monthly magazine. Vols. I to V; 1904-1908. To be obtained from the Hawaiian Gazette Co., Honolulu. Price \$1 a year.

DIVISION ON ENTOMOLOGY.

"The Leaf-Hopper of the Sugar-Cane," by R. C. L. Perkins. Bulletin No. 1; 33 pp.; 1903.

** "A Catalogue of the Hemipterous Family Aleyrodidae," by G. W. Kirkaldy, and "Aleyrodidae of Hawaii and Fiji with Descriptions of New Species," by Jacob Kotinsky. Bulletin No. 2; 102 pp.; 1 plate; 1907.

* "On Some Diseases of Cane Specially Considered in Relation to the Leaf-Hopper Pest due to the Stripping of Cane," by R. C. L. Perkins. Press Bulletin No. 1; 4 pp.; 1904.

"A Circular of Information," by Jacob Kotinsky. Circular No. 1; 8 pp.; 1905.

"The Japanese Beetle Fungus," by Jacob Kotinsky and B. M. Newell. Circular No. 2; 4 pp., cut; 1905.

Report of the Division of Entomology, for the year ending December 31, 1905.

Reprint from Second Report of the Board; 68 pp.; 3 plates; 10 text figures.

Report of the Division of Entomology, for the year ending December 31, 1906.

Reprint from Third Report of the Board; 25 pp.; 7 text figures.

Report of the Division of Entomology, for the year ending December 31, 1907.

Reprint from Fourth Report of the Board; 18 pp.; 1 plate.

Report of the Division of Entomology, for the year ending December 31, 1908.

Reprint from Fifth Report of the Board; 26 pp.; 2 plates.

PUBLICATIONS FOR DISTRIBUTION—Continued.

DIVISION OF FORESTRY.

- * "Forest and Ornamental Tree Seed for Sale at Government Nursery." Press Bulletin No. 1; 3 pp.; 1905.
- "Suggestions in Regard to the Arbor Day Tree Planting Contest." Press Bulletin No. 2; 7 pp.; 1905.
- "An Offer of Practical Assistance to Tree Planters." Circular No. 1; 6 pp.; 1905.
- "Revised List of Forest and Ornamental Tree Seed for Sale at the Government Nursery." Press Bulletin No. 3; 4 pp.; 1906.
- "Instructions for Propagating and Planting Forest Trees." Press Bulletin No. 4; 4 pp.; 1906.
- Report of the Division of Forestry, for the year ending December 31, 1905. Reprint from Second Report of the Board; 77 pp.; 5 plates.
- Report of the Division of Forestry, for the year ending December 31, 1906. Reprint from Third Report of the Board; 123 pp.; 4 maps.
- Report of the Division of Forestry, for the year ending December 31, 1907. Reprint from Fourth Report of the Board; 70 pp.
- Report of the Division of Forestry, for the year ending December 31, 1908. Reprint from Fifth Report of the Board; 85 pp.

DIVISION OF ANIMAL INDUSTRY.

- * "Inspection of Imported Live Stock." Rule 1; 1 p.; 1905.
- * "Inspection and Testing of Imported Live Stock for Glanders and Tuberculosis." Rule 2; 1 p.; 1905.
- "Concerning Glandered Horse Stock in the Territory." Rule 3; 1 p.; 1905.
- * "To Amend Rule 1, Inspection of Imported Live Stock." Rule 4; 1 p.; 1907.
- "Rules and Regulations, Inspection and Testing of Live Stock." Rules 1 to 7; 10 pp.; 1908.
- "Quarantine of Horse Stock from California." Rule 8; 1 p.; 1908.
- Report of the Division of Animal Industry, for the year ending December 31, 1905. Reprint from Second Report of the Board; 62 pp.
- Report of the Division of Animal Industry, for the year ending December 31, 1906. Reprint from Third Report of the Board; 41 pp.; 3 plates.
- Report of the Division of Animal Industry, for the year ending December 31, 1907. Reprint from Fourth Report of the Board; 104 pp.; 6 plates.
- Report of the Division of Animal Industry, for the year ending December 31, 1908. Reprint from Fifth Report of the Board; 44 pp.

* Out of Print.

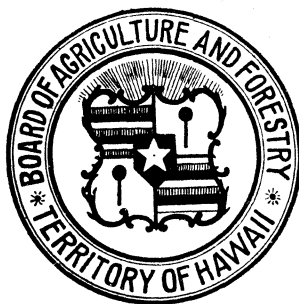
** This Bulletin will be sent only to persons interested in the subject.

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Issued March 11, 1911

REPORT
OF THE
BOARD OF COMMISSIONERS OF
AGRICULTURE AND FORESTRY

OF THE
TERRITORY OF HAWAII

FOR THE
BIENNIAL PERIOD ENDING DECEMBER 31st, 1910



HONOLULU, T. H.
HAWAIIAN GAZETTE CO., LTD.
1911

Board of Agriculture and Forestry.

DIVISION OF FORESTRY.

FOREST AND ORNAMENTAL TREE SEED AND SEEDLINGS FOR SALE AT THE GOVERNMENT NURSERY.

The Division of Forestry keeps constantly on hand at the Government Nursery, seed and seedlings of the important native and introduced trees. These are sold at prices just covering the cost of collection or growing.

The list includes both forest and ornamental trees, such as Silk Oak, Koa, various species of Eucalyptus, Golden and Pink Showers, Pride of India, Poinciana, Albizzia, etc. The price of the seed varies from 10 to 50 cents per ounce. The seedlings may be had for 2½ cents each, except a few kinds which are 5 cents. Seed of the various palms is also for sale; the price per 100 varying from \$1.00 to \$2.50. All seed is tested before being sent out, which insures its being good.

All communications in regard to seed or trees should be addressed to David Haughs, Forest Nurseryman, Box 207, Honolulu, Hawaii.

RALPH S. HOSMER,
Superintendent of Forestry.

DIVISION OF ENTOMOLOGY.

To give information about insects free of charge is one of the duties of this Division and Hawaiian readers are hereby invited to make inquiry in person and by mail. In order to be able to advise intelligently or send the right kind of useful insects for relief we like and sometimes it is indispensable for us to see the insect suspected or caught in the act, also specimens of the injury. In a tin with a hole or two, or a wooden box specimens may be mailed at 3rd class rates. When specimens are not accompanied by letter *always* write your name and address in the upper left-hand corner of the package. Address all communications SUPERINTENDENT DIVISION OF ENTOMOLOGY, P. O. BOX 207, HONOLULU, HAWAII.

EDW. M. EHRHORN,
Superintendent.

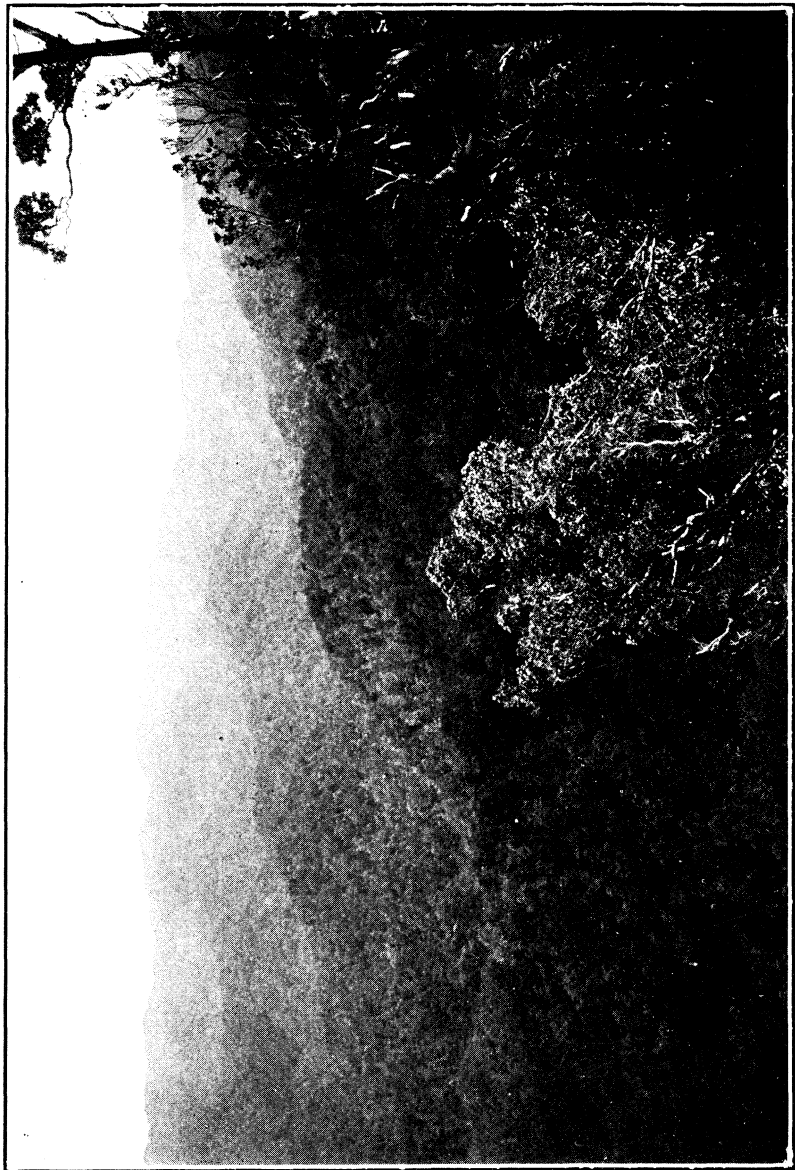
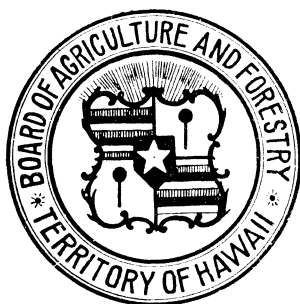


Plate 1. A Completely Forested Watershed.

Phot. by R. A. Bonine

REPORT
OF THE
BOARD OF COMMISSIONERS OF
AGRICULTURE AND FORESTRY
OF THE
TERRITORY OF HAWAII
FOR THE
BIENNIAL PERIOD ENDING DECEMBER 31st, 1910



HONOLULU, T. H.
HAWAIIAN GAZETTE CO., LTD.
1911

OFFICERS AND STAFF

OF THE

Board of Commissioners of

Agriculture and Forestry

1910

COMMISSIONERS.

NAME	TERM EXPIRES
MARSTON CAMPBELL, <i>President and Executive Officer,</i>	January 1, 1914
P. R. ISENBERG, - - - - -	" " 1915
J. M. DOWSETT - - - - -	" " 1913
H. M. VON HOLT - - - - -	" " 1911
ALBERT WATERHOUSE (In Mr. Dowsett's absence) - - - - -	" " 1911

DIVISION OF FORESTRY.

Ralph S. Hosmer, *Superintendent of Forestry and Chief Fire Warden.*
David Haughs, *Forest Nurseryman.*
Joseph F. Rock, *Botanical Assistant.*
Bro. Matthias Newell, *in charge of Sub-Nursery at Hilo, Hawaii.*
Walter D. McBryde, *in charge of Sub-Nursery at Homestead, Kauai.*
David Kapihe, *Forest Ranger for Tantalus.*

DIVISION OF ENTOMOLOGY.

Edward M. Ehrhorn, *Superintendent of Entomology and Chief Inspector.*
Albert Koebele, *Consulting Entomologist.*
H. O. Marsh, *Assistant Entomologist.*
D. B. Kuhns, *Inspector.*
Fred Muir, *Beneficial-Insect Collector.*
Bro. M. Newell, *Fruit and Plant Inspector, Hilo, Hawaii.*
Robert R. Elgin, } *Honorary Fruit* { *Mahukona, Hawaii.*
W. O. Aiken, } *and Plant Inspector* { *Kahului, Maui.*
W. D. McBryde, } *at* { *Koloa, Kauai.*
Dr. W. B. Deas, } { *Hana, Maui.*
Capt. C. F. Turne } { *Kaanapali, Maui.*

DIVISION OF ANIMAL INDUSTRY.

Victor A. Nörsgaard, *Superintendent of Animal Industry and Territorial Veterinarian.*
L. N. Case, *Assistant Territorial Veterinarian.*
John Vanhuizen, *Live Stock Inspector, (until November)*
J. C. Fitzgerald, *Deputy Territorial Veterinarian for Maui.*
H. B. Elliot, *Deputy Territorial Veterinarian for Hilo, Hawaii.*
A. R. Glaisyer, *Deputy Territorial Veterinarian for Kauai.*
E. L. Glaisyer, *Deputy Territorial Veterinary for Kohala and Hamakua, Hawaii.*

CLERICAL STAFF

Mrs. E. K. Brown, *Secretary to the Board,*
Miss Melika Peterson, *Clerk and Stenographer.*
Miss Ella K. Dayton, *Librarian.*

EDITOR, HAWAIIAN FORESTER AND AGRICULTURIST

DANIEL LOGAN

CONTENTS.

REPORT OF COMMISSIONERS.

	PAGE.
Report of the Commissioners.....	1
Personnel	1
Meetings	1
Publications	2
Division of Forestry.....	2
Division of Entomology.....	5
Division of Animal Industry.....	8
Conclusion	12
Appropriations and Expenditures:	
January to June, 1909.....	14
July, 1909, to December, 1910.....	15

DIVISION OF FORESTRY.

Report of the Superintendent of Forestry.....	17
Staff and appropriations.....	19
Forest reserves	19
New reserves	22
Object of certain reserves.....	22
Minor changes in forest reserves.....	23
Table showing area of forest reserves:	
Reserves arranged in chronological order.....	24
Reserves arranged by islands and counties.....	26
Forest reserves pending.....	28
Planting in forest reserves.....	28
Forest fence at Pupukea.....	29
Condemnation of forest land on Kohala Mountain.....	29
Forest extension	30
Assistance to forest planters.....	30
The establishment of sub-nurseries.....	31
The nursery at Homestead, Kauai.....	32
Trees distributed from Homestead nursery.....	32
The Hilo nursery	33
Trees distributed from Hilo nursery.....	33
Temporary distributing stations	33
Arbor and Conservation Day.....	34
Statistics of Arbor Day distribution.....	35
Tree planting by corporations.....	36
Number of trees reported planted (table).....	37
Plant introduction work	39
Federal experimental planting	40
Eucalyptus study	41
Botanical investigations	41
Miscellaneous forest work.....	42
Rubber investigation	42
Exhibits and educational work.....	43
National Irrigation Congress.....	44
Cooperation with other local institutions.....	44
Lumbering operations	45
Forest fires	46
The District Foresters.....	46

Reports of District Foresters:	
Report of A. S. Wilcox	47
" " W. R. Castle	47
" " H. B. Penhallow	48
" " L. von Tempsky	48
" " Geo. C. Watt	51
" " John Watt	51
" " R. von S. Domkowiez	51
" " John Maguire	52
Summary of recommendations	53
Report of the Forest Nurseryman	56
Nursery	56
Collection and exchange of seeds	56
Seed received through exchange	57
Distribution of plants from Government Nursery and Ma-	
kiki Station	59
Free list	60
Nursery grounds	61
Realizations	61
Advice and assistance	62
Kukaiu Plantation Company	62
Lower Pauhala in Kaikele, Oahu (Kunia)	62
Pioneer Mill	62
Grove Farm	63
Pupukea, Koolauloa, Oahu	63
Waialua Agricultural Company	63
Congressional vegetable seed	63
Experiment Garden, Makiki	63
Tantalus forest	65
Nuuanu Station	66
Report of the Botanical Assistant	67
The Herbarium	67
Forest and botanical exhibit	69
Botanical explorations	71
North Kona, Hawaii	71
Puuwaawaa	73
Hualalai	73
Waimea	76
Exploration on Kauai	76
Visit to Molokai	78
Kohala, Hawaii	78
Trip to Lanai and West Maui	79
Exploration of Haleakala	80
Ulupalakua	81
Collection of native seed	82
Exchange of herbarium specimens	82
Investigation of stock-poisoning plants	82
Eucalyptus investigation	82
Plants new to science	83
Scaevola Swezeyana Rock	83
Pittosporum Hosmeri Rock	84
Sideroxylon rhynchospermum Rock	84
Lysimachia glutinosa Rock	85
Dubautia Waialealae Rock	86
Herbarium extension	87
List of District Foresters	89
List of District Fire Wardens	93
Address delivered at special Conservation meeting	98

DIVISION OF ENTOMOLOGY.

	PAGE.
Report of the Superintendent of Entomology, 1909.....	103
Staff	103
Superintendent	103
Consulting Entomologist	103
Assistant Entomologist (see also recommendations).....	103
Inspectors and assistants.....	104
Lines of work	104
Inspection, quarantine and disinfection of plants, fruits and vegetables, Honolulu	105
Inspection, quarantine and disinfection of plants, fruits and vegetables, Hilo	106
Table, monthly inspection giving average and quantity of vege- table matter inspected and manner of its disposal.....	107
Potato Scab	108
Cotton and rice industries.....	108
Insects intercepted in course of inspection in 1909.....	109
Bugs (Hemiptera-Homoptera)	109
Beetles (Coleoptera)	110
Flies (Diptera)	111
Ants	111
Miscellaneous pests	112
Fruits and vegetables received in Honolulu, 1909.....	113
Beneficial insect distribution, 1909.....	115
Introduction of Smyrna fig insect, 1909.....	115
Prof. Koebele's work on Horn Fly, by O. H. Swezey, 1909..	116
Pineapple Scale	121
Recommendations ..	121
Inter-island inspection	121
Serious pests to be combated.....	122
Report of the Superintendent of Entomology, 1910.....	123
Staff	125
Superintendent	125
Consulting Entomologist	125
Assistant Entomologist	126
Inspectors, Honolulu and Hilo.....	126
Honorary Inspectors	127
Lines of work	127
Inspection, quarantine and disinfection of imported vegetable matter, Honolulu	128
Inspection, quarantine and disinfection of imported vegetable matter, Hilo	129
Fruits and vegetables received in Honolulu, 1910.....	130
Inspection of fruits, plants and vegetables in Oriental cargoes, 1910	132
Improvement of shipment of fruits and vegetables received at Honolulu and Hilo.....	133
Inspection of seeds, plants and fruit at U. S. postoffice.....	133
Additional equipment and improvements on docks.....	134
Pests intercepted in course of inspection.....	135
Beetles (Coleoptera)	135
Moths (Lepidoptera)	135
Bugs (Hemiptera)	135
Scale insects (Coccidae).....	136
Miscellaneous pests	136
Diseases intercepted	136

	PAGE.
Infested sugar cane	137
Banana borers and diseases.....	137
Snakes	137
Hitchcock or Thimbleberry— <i>Rubus jamaicensis</i>	137
Figs and fig insects.....	138
Fruit flies	138
Rule and regulation concerning the prevention of distribution of the Mediterranean Fruit Fly from Oahu to the other islands	140
Rule and regulation concerning the importation of banana fruit, banana shoots or plants.....	141
Beneficial insect distribution	142
Beneficial insects established	143
Importation and work of Hornfly parasites, by Dr. R. C. L. Perkins, 1910	143
Insect collection	145
Acknowledgements	146
Recommendations	146
The introduction of birds into the Hawaiian Islands.....	147
Letter by Dr. H. W. Henshaw.....	148
Report of Assistant Entomologist.....	152
Some experiments on the Chrysanthemum Plant Louse (<i>Macro-</i> <i>siphum sanborni</i>) by H. O. Marsh.....	160
Experiments with remedies.....	162
Summary of experiments	168
Apparatus and insecticides used.....	169
General directions for spraying.....	170
Remedy recommended	172

DIVISION OF ANIMAL INDUSTRY.

Letter of submittal.....	173
Report of Territorial Veterinarian.....	175
Introduction	175
Rules and regulations.....	175
New animal quarantine station.....	176
Simple quarantine	177
Infectious diseases	177
Quarantine station in Hilo.....	178
Importation of live stock.....	178
Horses	179
Mules	181
Cattle	181
Sheep	182
Hogs	183
Poultry	184
Dairy products	184
Diseases among live stock.....	185
Glanders	185
Bovine tuberculosis	186
International Commission on the control of bovine tubercu- losis	187
Prevalence of bovine tuberculosis.....	190
The Intra-Dermal tuberculin test.....	191
Recommendations	193
Summary of recommendations.....	194
Conclusions	198
Reports of officers of the Division of Animal Industry....	198

	PAGE.
Report of the Assistant Territorial Veterinarian.....	199
Red Water in cattle.....	199
Characterization	199
Distribution in the Territory.....	199
History	199
Symptoms	199
Blood examinations	200
Blood parasites	201
Morbid anatomy	201
Etiology	202
Prevention	203
Eye Worm in chickens.....	204
Characterization	204
Distribution	204
Etiology	204
Symptoms	204
Treatment	205
Sheep Botflies in California rams on Island of Lanai.....	205
Symptoms	206
Pathology	206
Prevention and treatment.....	207
Conclusions	208
Report of the Deputy Territorial Veterinarian for the Hilo District	
for 1909	209
General observations	209
Port inspection	209
Contagious and infectious diseases.....	209
Glanders	209
Quarantine Station at the Port of Hilo.....	210
Endemic Catarrhal Fever.....	211
Actinomycosis, or Lumpy Jaw.....	211
Miscellaneous infective diseases	212
Parasitic diseases of horses and mules.....	212
Report of the Deputy Territorial Veterinarian for the Hilo District	
for 1910	217
General observations	217
Port inspection	218
Quarantine facilities at the Port of Hilo.....	218
Milk and meat supply of the Town of Hilo.....	219
The mule market on the Pacific Coast.....	220
Report of the Deputy Territorial Veterinarian for the District of	
Maui	223
Animal diseases on Maui.....	223
Glanders	223
Cerebro-Spinal Meningitis	224
Tetanus	225
Liver Fluke disease	225
Tuberculosis	226
Veterinary hospitals	226
Hygiene and meat inspection.....	228
Report of the Deputy Territorial Veterinarian for Kauai.....	229

ILLUSTRATIONS.

Plate 1.	A completely forested watershed.....	Frontispiece
		Facing Page
" 2.	A forest cover protects the streams.....	17
" 3.	Eucalyptus robusta on Tantalus.....	32
" 4.	Eucalyptus citriodora in the Tantalus forest.....	32
" 5.	The Government Nursery, Honolulu.....	32
" 6.	Views of the Hilo Nursery.....	33
" 7.	Experimental Garden, Makiki Valley, Honolulu.....	40
" 8.	Interior of propagating house, Government Nursery.....	40
" 9.	Native undergrowth coming up under a planted forest....	65
" 10.	<i>Wilkesia gymnoxyphium</i> Gray. Iliou.....	70
" 11.	Plant specimens for Alaska-Yukon-Pacific Exposition....	70
" 12.	Wood specimens exhibited at Seattle.....	70
" 13.	Hawaiian Red Cotton, <i>Gossypium drynarioides</i> Seem.....	72
" 14.	<i>Lobelia Kauaiensis</i> (Gray) Heller.....	77
" 15.	<i>Brighamia insignis</i> Gray.....	73
" 16.	<i>Lobelia Gaudichaudii</i> DC.....	78
" 17.	<i>Argyroxiphium Sandwicense</i> DC: <i>Beta</i> var. <i>macrocephalum</i> Hbd.	80
" 18.	Silver Sword in flower. Ahinahina.....	80
" 19.	<i>Alectryon macrococcum</i> Radlkf.....	80
" 20.	<i>Pittosporum Hosmeri</i> Rock.....	84
" 21.	<i>Sideroxylon rhynchospermum</i> Rock.....	84
" 22.	<i>Dubautia Waialealae</i> Rock.....	86
" 23.	Laboratory and Fumigatory on Oceanic Wharf.....	120
" 24.	Interior of Laboratory on Oceanic Wharf.....	136
" 25.	Interior of office on Alakea Wharf.....	137
" 26.	Thimbleberry. <i>Rubus jamaicensis</i>	137
" 27.	Australian snakes prevented from entering Hawaii by the Board of Agriculture and Forestry.....	137
" 28.	Mediterranean Fruit Fly; all stages.....	144
" 29.	Orange showing adult Fruit Flies at rest.....	144
" 30.	Spraying Equipment	160
" 31.	Interior of Insectary	160
" 32.	Photo showing check plants and portion sprayed in Exp. 7	169
	New Animal Quarantine Station, Beach Road, Honolulu..	173
" 33.	New Animal Quarantine Station, Beach Road, Honolulu..	176
" 34.	New Animal Quarantine Station; Main Alley.....	176
" 35.	Glanders division of new Quarantine Station.....	177
" 36.	Shelter and feed rack, new Quarantine Station.....	177
" 37.	Aged and crippled mares, imported for mule breeding, but rejected	184
" 38.	Another mare from the same shipment.....	184
" 39.	Mare from same shipment developing <i>Purpura</i> <i>Hemorrhagica</i> (Mud Fever).....	184
" 40.	One of a consignment of heifers imported by Parker Ranch	184
" 41.	Veterinary Hospital, Maui.....	228
" 42.	Fig. 1. Horse bath in operating room.....	228
	Fig. 2. Dispensary. Camp I Hospital.....	228
" 43.	Fig. 1. Interior of loose boxes. Camp I Hospital.....	228
	Fig. 2. Cold water treatment apparatus. Camp I Hospital	228
" 44.	Exterior of new stables. Camp I.....	228
	Fig. 2. Interior of half of new stables. Camp I.....	228

Board of Agriculture and Forestry.

Report of the Commissioners.

Honolulu, Hawaii, December 31, 1910.

Hon. Walter F. Frear,
Governor of Hawaii,
Honolulu, Hawaii.

Sir:—The Board of Commissioners of Agriculture and Forestry has the honor to present herewith its report for the biennial period ending December 31, 1910.

PERSONNEL.

On January 26, 1909, the Governor appointed Mr. Marston Campbell, President and Executive Officer, and Mr. J. M. Dowsett as member of the Board. In September, 1909, Mr. Albert Waterhouse resigned on account of expected absence from the Territory. This created a vacancy in membership which has not been filled. But Mr. Waterhouse was reappointed on April 15, 1910, for the remainder of that calendar year, to act for Mr. Dowsett during the absence of the latter from the Territory.

MEETINGS.

During 1909 the Board held 18 regular and 2 executive meetings; in 1910 19 regular and one executive meeting.

Jointly with the Governor, there were held two Forest Reserve hearings in 1909, and three in 1910.

On November 16, 1910, a special Conservation Meeting, under the joint auspices of this Board and the Hawaiian Sugar Planters' Association, was held in the Throne Room at the Capitol, at which addresses were made by the Governor, the President of the Board and a number of other gentlemen, dealing with the practical application of the principles of Conservation to some of our local problems.

PUBLICATIONS.

The Hawaiian Forester and Agriculturist has continued to be published as the official organ of the Board. During the past year considerable attention has been paid to making public the official records of the Board, the full minutes of the several meetings having been regularly published, together with the monthly reports of the three Chiefs of Division. In January, 1910, Mr. Daniel Logan succeeded Mr. Leopold G. Blackman as editor. The magazine has continued to be published by the Hawaiian Gazette Company.

In October, 1909, a press bulletin entitled "Instructions for Planting Forest, Shade and Ornamental Trees, with Brief Notes on Propagation," was issued by the Division of Forestry, in English and in Hawaiian, the two being numbered respectively Press Bulletins 5 and 6, Division of Forestry.

In January, 1910, the Division of Animal Industry issued an 11-page circular (unnumbered) entitled "Rules and Regulations pertaining to the Inspection and Testing of Live Stock intended for importation from the mainland of the United States to the Territory of Hawaii." This circular contains a revision of the rules and regulations of the Division of Animal Industry, effective from January 1, 1910.

In November, 1910, the Division of Entomology issued as an unnumbered leaflet Rule VII, "Concerning the Prevention of Distribution of the Mediterranean Fruit Fly from Oahu to the other Islands."

While not strictly a Board publication there was also issued under its supervision in the spring of 1909, pamphlets containing, in English and in Hawaiian, the full minutes of a special Conservation Meeting held jointly by the Senate and House of Representatives of the Territory of Hawaii on March 1, 1909, at which meeting various addresses were delivered on the meaning of Conservation and the need locally for the practical application of Conservation principles.

DIVISION OF FORESTRY.

The work of the Division of Forestry has been continued during the past two years along the same lines that have marked it heretofore, but a greater share of attention has been given to the distribution and planting of trees. There have been no changes in the regular staff, but for a period of six months, from November, 1909, to May, 1910, Mr. Louis Margolin, of

the staff of the Forest Service of the U. S. Department of Agriculture, was temporarily detailed to Hawaii to carry on a special investigation of the planted groves of Eucalyptus.

The activities of the Division of Forestry can readily be divided into two parts: First, the creation and administration of forest reserves, for the most part areas of native Hawaiian forest covering important watersheds that it is advisable be kept intact for the protection of the supplies of water needed for irrigation, power development or domestic uses. Second, the extension of a forest cover over areas of waste or barren land, or in sections that can be used to better advantage for growing trees than for any other purpose.

During 1909 four new forest reserves were set apart by proclamation of the Governor, aggregating a total of 101,614 acres, of which 83,234 acres, 82 per cent., is government land. In 1910 three more reserves were set apart, all government land, aggregating 29,132 acres.

There are now 23 established forest reserves in Hawaii with a total area of 575,154 acres, of which 386,547 acres, or 67 per cent, is government land.

In tree planting the Division of Forestry helps the people of the Territory in several ways. It gives advice as to how, what and when to plant. It furnishes seed and seedlings at cost price, with many special periods of free distribution. And as far as appropriations permit, it plants forests itself on government land. Through special allotments from the Conservation fund tree planting by the Government has been done during the past year at Pupukea, Oahu, and trees are being made ready for planting on the Kohala Mountain, Hawaii, above Waimea Village.

In 1909 and again in 1910 special efforts were made on Arbor Day to give out to a large number of persons throughout the Territory trees for planting on their own land. Sub-nurseries and temporary distributing stations were established from which, with the Government Nursery at Honolulu, there were given out, free, 63,614 trees in 1909 and 30,482 in 1910. But this is but a small part of the trees actually distributed. The total sent out from the various nurseries including those given free is 112,590 for 1909 and 264,573 for 1910.

Tree planting in Hawaii is, however, not by any means all a matter of government effort. A table of trees planted by corporations and others, prepared by the Division of Forestry shows that in 1910 there were set out in the Territory seven hundred and twenty-five thousand trees. This proves that the leading corporations are awake to the desirability of tree plant-

ing, but it can also well be used as an argument for more work of like character.

There is much need in Hawaii for the planting of forest of commercial character. There is also need for the better protection of the native forest and for the extension of the Algaroba forest.

In having this tree Hawaii is indeed fortunate, but there are large areas of land on each island which are now almost barren, or at any rate of low value, that ought to be growing Algaroba. The Algaroba can be propagated very easily and when once established will take care of itself. Not only will it pay corporations to assist its spread; it will bring them a large return on the comparatively small amount of money that needs to be invested to help this tree get started.

Another line of work of the Division of Forestry is the introduction of trees new to the Territory. What we need in Hawaii is trees that will take care of themselves and spread naturally. The introduction work is the only systematic way of getting such species here and establishing them. In its experimental garden at Makiki the Division of Forestry is now growing many valuable trees and shrubs new to the Territory. Later those found to be most desirable will be propagated and distributed. During 1910 the seed of many plants have been received from Mr. Gerrit P. Wilder, a former Commissioner of this Board, from various places which he has visited in a trip around the world.

Two special lines of investigation carried on by the Division of Forestry during the past two years are the study of the planted forests of Eucalypts, already referred to, and the botanical survey of the Territory, now being made by the Botanical Assistant of the Division of Forestry, Mr. Joseph F. Rock. Many valuable specimens of native Hawaiian plants have been secured and a great deal of data compiled which will be of value to the Territory in many ways. Mr. Rock's work includes, too, a study of the plants found on the ranches, both weeds and beneficial species. In due time the information got together will be made public in such form that it can readily be used by the general public. But to get the necessary data requires first that exact scientific work be done.

One of the pressing needs of the Board is for more money for the publication of bulletins giving the results of the investigations carried on by its several divisions. The manuscript of four such reports now lies in the safe because of lack of funds, and all are bulletins that when published will be of direct, practical assistance to the people of the Territory. This is a side of the work of this Board that ought surely to be provided for better in the

future. Of the needs of the Division of Forestry in general for the future, the special demand is for sufficient money adequately to protect the native forest in existing forest reserves through the fencing of forest reserve boundaries, the protection of the forest from trespass by means of forest rangers, and a special fund for fighting forest fire, should that need unfortunately arise. Next, provision ought to be made for the extension of forest planting by the Government in open places in the forest reserves and on other government land which ought to be brought under forest cover. It is the established policy of the Board to start and maintain sub-nurseries for the distribution of trees on each of the main islands. Provision should be made for this work and also for the introduction and trial of plants and shrubs new to the Territory, and for the continuation of the investigations of the botanist, including the care of the material collected by him in an enlarged Herbarium.

As with the other Divisions the report of the Division of Forestry describes in detail the various branches of work here outlined.

DIVISION OF ENTOMOLOGY.

The work of the Division of Entomology consists in the control of the introduction of insects into the Territory and the devising and application of methods to check the spread and reduce the damage done by injurious insects already established here.

On October 1, 1909, Mr. Edward M. Ehrhorn replaced Mr. Jacob Kotinsky as Superintendent of Entomology, Mr. Kotinsky returning to his former position of Assistant Entomologist. Mr. Ehrhorn came to Hawaii from California where, as Chief Inspector at the Port of San Francisco, he had succeeded Mr. Alexander Craw, Superintendent of Entomology under this Board from 1904 to 1908.

Mr. Kotinsky resigned as Assistant Entomologist at the end of January, 1910, and left the country. That position was vacant until July 1, when Mr. H. O. Marsh, then of the staff of the Bureau of Entomology of the U. S. Department of Agriculture, was appointed.

Mr. Albert Koebele still holds the position of Consulting Entomologist and has been absent from the Territory, collecting, during the period covered by the report. He has been in Europe where he has been studying the Hornfly and its parasites in an endeavor to procure such of these as would prove beneficial to the islands in checking this terrible pest of our cattle.

Mr. D. B. Kuhns has continued as Inspector's Assistant, aided from August 1, 1909, to August 1, 1910, by Mr. L. V. Lewis, who then, on account of shortage of funds and the appointment of an Assistant Entomologist, dropped out of the service.

Brother Matthias Newell continues faithfully to perform his duties as regular inspector at the Port of Hilo. Our honorary inspectors, consisting of Messrs. Robert E. Elgin at Mahukona, Hawaii; W. O. Aiken at Kahului, Maui; W. D. McBryde at Koloa, Kauai; Wm. Robb, Lahaina, Maui; and Dr. W. D. Deas, Hana, Maui; still remain with us and are ready to serve us when occasion requires.

In 1909 363 vessels were boarded, about half of which carried vegetable matter. On an average 588 lots and 13,353 parcels were inspected last month. The strict inspection of potatoes and the return to California of a large number of sacks of potatoes affected with Potato Scab has had a decided influence in bettering the grade now received.

During 1910 the greater part of the work of the Division consisted in inspection. The inspection list shows about $18\frac{1}{2}$ per cent increase in packages and $42\frac{1}{2}$ per cent increase in different marks or lots received. The total number of packages inspected in 1910 was 210,058, of which number some 427 packages were destroyed on account of pests or diseases, or prohibition of entry into the Territory. Another lot of snakes was condemned and killed. The longest measured 9 feet. They were brought here for exhibition, but under the law could not be admitted.

Through the coöperation of the Superintendent of Public Works additional facilities on the Alakea Wharf have been provided and the Division's fumigatories improved, so that they are now in excellent shape for efficient work.

The appearance of a new pest, the Mediterranean Fruit Fly, has caused the passage of a new regulation which prohibits the shipment of soft meated fruits to the other islands of the Territory. This is Rule VII.

Another rule and regulation, No. VIII, has been passed by the Board prohibiting the entry into the Territory of Banana fruit and plants from Central America and other sections, where exists a disease which has killed off thousands of acres of Banana plantations and which is now causing growers of this fruit to look to other countries for the proper lands for its cultivation. Under these conditions Hawaii has a bright future for a paying industry and it behooves us to nip any danger, as mentioned above, in the bud.

The increase in shipments warrants provision being made for a Dock Assistant. Only since the appointment of Mr. Marsh has the Division of Entomology been able to carry on field experiments to any extent.

The introduction and propagation of parasites and beneficial insects has been seriously hampered both in 1909 and in 1910 by the shortage of assistants and an inadequate insectary, but in both years as much attention was paid to this branch of the work as limited staff and small funds permitted. Despite this fact the Division of Entomology was able during 1910 to liberate large colonies of beneficial parasites aggregating 160,954 individuals. With an adequate appropriation, a well trained assistant and an enlarged insectary far greater results could be had.

The report of the Superintendent of Entomology for 1909 gives a detailed statement of the Hornfly parasite investigations being carried on by Prof. Koebele.

Since his appointment as Assistant Entomologist, Mr. Marsh has been carrying on a valuable series of field experiments, excellent results having been obtained in experiments on the pests of the truck gardens, which are very encouraging to growers in this branch of agriculture. A full account of this work is given in Mr. Marsh's report.

The officers of the Division of Entomology have been frequently consulted during the past two years in regard to the treatment of pests and diseases, infested plants and trees, and much help has been given to individual applicants. The Superintendent has made trips to the other islands as often as his very limited time permitted. The routine duties of inspection are so great, however, that with the shortage of an assistant only very few trips were possible. This is a branch of the work which ought to be expanded. With adequate assistance through an increased staff the Superintendent of Entomology would be able to devote more time to these matters.

Of the future needs of the Division of Entomology, in addition to the increase of staff and the improved insectary already referred to, the most pressing is for an adequate allotment for the collection and importation of beneficial parasites. It is especially desirable that the natural enemies of the Melon Fly and the Alligator Pear Scale be secured.

It is already known where such parasites can be secured. It waits now for funds to be provided with which to send properly trained men to do the work.

DIVISION OF ANIMAL INDUSTRY.

The principal objects of this Division may be divided into three, all of which lead to the same end, that is, the development of the live stock industry of the Territory, as follows: Measures to prevent the introduction of infectious and contagious diseases, measures to control, suppress and eradicate such diseases as already have gained a foothold here, and the investigation of diseases of whatever nature which are or may become of economic importance to the live stock industry of the Territory, as well as to the public health in general.

For the purpose of attaining this end a number of laws have been enacted by the last three legislatures (the Division of Animal Industry dates back only five years) and supported by these laws a number of rules and regulations have been promulgated and amended as required by exigencies, until it may safely be asserted that no State or Territory in the Union is better protected in so far as its live stock and related industries are concerned as the Territory of Hawaii. That this result has been obtained in such a short space of time is to a great extent due to the unique position of the Islands, which makes it possible to guard all ports of entrance through which infection might reasonably be expected to come in—and furthermore to the unstinted aid which this Board has received from the federal Bureau of Animal Industry, in its efforts to prevent the further introduction of deleterious diseases as well as in the eradication of diseases already here, as for instance tuberculosis.

During the past year the rules and regulations of the Division of Animal Industry have been completely revised and a new edition issued, which took effect on January 1, 1910. No radical deviation from the policy previously followed by the Board was resorted to, with one exception. The rule, which imposes a three weeks' quarantine on all horse stock coming from or through the State of California was amended so as to make it compulsory for such stock to be confined during the quarantine period on premises provided by the Territorial Government, while previously the owner had been permitted to provide or use his own premises if upon inspection they were found to be satisfactory to the Board. This latter arrangement, which had been necessitated by the lack of a suitable quarantine station, or funds wherewith to provide the same, had proven highly unsatisfactory, and must of necessity be considered a provisional or makeshift quarantine at best, and dependent upon the owners' inclinations or desires for its effectiveness. The Board therefore decided,

when the "Conservation Act" was passed, to authorize the building of a modern animal quarantine station.

After many premises and localities had been considered a suitable location was found on the Ala Moana Road, at once convenient to the office of the territorial veterinarian and at the same time approachable from the entire waterfront. With no buildings or dwellings within 1,000 feet, with perfect drainage through a sandy soil to coral bottom, with a good growth of algaroba trees for shade, the location comes close to being perfect for a quarantine station. A lease was obtained on a practically level piece of this land, containing 3 acres, with a frontage of 265 feet on the Beach Road. This piece of land was enclosed with 5' woven wire "Page" fence, and subdivided into a glanders division, a hog cholera division,—both of which were surrounded with solid board fence 7' high,—and a detention division consisting of ten paddocks of varying sizes, accommodating as many as 30 head of horses or mules each.

The glanders division is, as stated, completely separated from the detention or quarantine division, and serves for the immediate segregation of any animal showing symptoms of a suspicious nature. It contains a chute for the testing, treating or confining for examination fractious animals, and is provided with six separate stalls. This division opens directly on the Beach Road by large sliding doors, through which a herd of cattle or a bunch of horses may be introduced and kept confined for testing or treatment without coming in contact with suspicious cases which may happen to be in the stalls.

The hog cholera division is also enclosed by a solid board fence, seven feet high, and is divided into four sections, one of which, when finished, will contain a small abattoir for the proper butchering of exposed but unaffected animals.

The station has so far been found large enough to accommodate all the animals requiring quarantine at one time, but if more than two steamers carrying a full consignment of livestock should arrive within two weeks of each other the quarters might be found insufficient. Provision should be made at once for completing the equipment of this station.

The animal quarantine station, which was provided for Hilo about 3 years ago, has proven entirely inadequate and negotiations are now under way for the acquiring by this Board of the unexpired lease of the old race track grounds outside of Hilo and which can be made into a very suitable and convenient station at a reasonable cost. It is absolutely essential that adequate provision be made for the proper equipment of the quarantine

station at Hilo. Unless this is done it will be impossible properly to handle the inspection work at this port, which is annually growing in importance.

The importation annually of a large number of head of live stock has continued during the past two years. This includes both horses belonging to the various branches of the U. S. War Department and animals imported by the leading ranches and others. A number of shipments of pure bred stallions, bulls and rams have been brought in for breeding purposes. These important matters are all treated at length in the report of the Superintendent of Animal Industry.

The general health of the live stock of the Territory has been excellent as compared to previous years. This is so much more remarkable as a prolonged drouth during the first year of this period caused considerable losses on practically all of the islands. No epidemic of a serious nature has occurred and only glanders continues to make its appearance here and there. However, more than one hundred cases of glanders have been located and eradicated and it is safe to predict that the continued fight against this disease will lead to its eradication before very long.

Through the efforts of years the live stock sanitary service has finally been completed with the recent appointment of a Deputy Territorial Veterinarian for the Districts of Kohala and Hamakua on the Island of Hawaii. All the principal islands are thus safeguarded against the spread of infectious and contagious diseases which might make their appearance and get beyond control before measures of prevention could be taken through the headquarters of the Board in Honolulu. The islands of Maui and Kauai have now been provided with Deputy Territorial Veterinarians for more than two years while the Deputy at Hilo, Hawaii, has been located there for a number of years, but has been handicapped in his work by having too large a district to attend to.

The importance of the work of these deputies cannot be overestimated. On Kauai, for instance, there is no glanders among the horse stock and has not been for a number of years. The Deputy on that island has therefore applied himself to see to it that the disease is not brought in from the other islands and has devoted his time to the eradication of tuberculosis. Most of the prominent dairy herds on that island have been tested for tuberculosis and all of the affected animals have been destroyed.

On the island of Maui glanders has been very prevalent and the deputy there has, during the past two years, located and

eradicated between thirty and forty outbreaks of this disease, submitting hundreds of animals to the mallein test. At the same time a number of herds of dairy cattle have been tested for tuberculosis and the affected animals destroyed.

The deputy in Hilo reports only one outbreak of glanders during the past year with only one animal affected and not a single outbreak in any of the plantation stables in his district. This is a record that cannot be too highly commented on considering that every one of the preceding years have seen a varying number of outbreaks both in plantation stables and among the outside animals. The recently appointed deputy for Kohala and Hamakua will undoubtedly find considerable work to do as glanders has been prevalent in the Hamakua District and especially in Waipio and Waimanu Valleys for a number of years.

As the deputies are all able men there is every prospect that their efforts in supporting the Territorial Veterinarian in the eradication of infectious and contagious diseases in the Territory will ultimately be crowned with success.

At present the salaries of these officials are paid by contributions made by ranches and sugar plantation companies. For many reasons it would be much more satisfactory and work for greater efficiency if the Deputy Territorial Veterinarians were on the regular pay-roll of the Board. This is a matter which should be given serious consideration by the Legislature.

On the side of investigations into the cause of animal diseases and appropriate remedies, lack of funds, a small staff and imperative calls in other directions have prevented expansion. But this is a branch of the work that ought not to be neglected. For its proper prosecution an animal experiment house is needed in connection with the laboratory at the Government Nursery. Provision should be made for the construction of such a building.

The most important problem before the Division of Animal Industry seems to be the eradication of bovine tuberculosis. Investigations made during the past two years had shown definitely that at least some of the local dairy herds were infected with this disease to an alarming extent. It was therefore decided upon to submit all dairy animals to the tuberculin test and the result showed that nearly twenty-five per cent were affected. This condition of affairs naturally created considerable alarm, especially in view of the admitted fact, that human tuberculosis, here as practically everywhere else, heads the list of causes of deaths, and especially among the native population. A number of dairy owners decided at once that milk from tuberculous cows should not be placed on the market and voluntarily began to dis-

pose of their diseased cattle. There are, however, many of the smaller dairy men who can ill afford to lose even a single animal and as public opinion has definitely decided that the tuberculous dairy animals must go, it has been planned to submit to the present legislature a bill for the partial remuneration of those owners of affected animals who voluntarily sacrifice their tuberculous cows for the good of the community. Such legislative action has been taken in a number of states and municipalities on the Mainland, and the system was officially recognized and adopted by an international tuberculosis commission, composed of the leading sanitarians of the United States and Canada, and who in the plan submitted by them for the control and eradication of this animal scourge stated: "That a policy of compensation be recommended as useful and usually necessary as a temporary measure."

Dr. Norgaard estimates that there may possibly be in the neighborhood of 600 head of tuberculous cattle in the City and County of Honolulu, and a far smaller number in the other counties of the Territory, and recommends that the destruction of these diseased animals be considered as a public health measure and that the losses resulting from the slaughter and possible condemnation of the carcasses as unfit for human consumption should be borne, at least equally by the public and by the owner.

Dr. Norgaard's plan for the complete eradication of bovine tuberculosis has met with the full approval of the members of this Board and will be supported by the municipal Board of Supervisors as well as by the local Board of Health.

CONCLUSION.

Through each of its Divisions the Board of Agriculture and Forestry is rendering direct, practical service to the people of the Territory. In Forestry, in Entomology and in Animal Industry it is doing work of fundamental importance for the development and continued well being of the islands.

But to carry on this work adequately requires better financial support than the Board has had in the past, or than it now receives. During the past two years the activities of each of the three Divisions have been hampered by lack of funds. And there are a number of new lines of work which ought actively to be pushed, that have of necessity had to wait because there was no money with which to carry them on.

Appropriations for such work as the Board of Agriculture and Forestry is doing are to be regarded in the light of investments, for although returns are not made in actual money, the benefits derived therefrom are none the less direct and tangible.

A careful reading of the accompany reports will show why this is so. The time has come when the work of this Board should receive support in a measure justified by its importance.

Very respectfully,

MARSTON CAMPBELL,
President and Executive Officer;

H. M. VON HOLT,

P. R. ISENBERG,

ALBERT WATERHOUSE,
Commissioners.

**APPROPRIATIONS FOR THE BOARD OF AGRICULTURE AND FORESTRY PASSED BY THE LEGISLATURE
AT THE SESSION OF 1907, FOR THE BIENNIAL FISCAL PERIOD, JULY 1, 1907, TO JUNE 30, 1909.**

Statement for the Period, January 1 to June 30, 1909.

	Appropriation.	Balance Dec. 31, 1908.	Amount Drawn.	Lapsed Balances.	Carried Over July 1, 1909.
SALARIES AND PAY ROLLS.					
Act 126, Regular Session, 1907—					
Salary of Superintendent of Forestry.....	\$ 6,000.00	\$ 1,500.00	\$ 1,500.00	\$	\$
Pay of Assistants, Laborers and Rangers, Division of Forestry	9,240.00	2,339.08	2,255.27	83.81	.....
Salary of Superintendent of Entomology.....	6,000.00	1,646.67	1,500.00	146.67	.....
Pay of Assistants, Inspectors and Employees, Division of Entomology	11,280.00	3,680.00	2,123.32	1,556.68	.....
Salary of Clerk and Stenographer.....	2,400.00	600.00	600.00	.....	.....
Pay of Employees and Laborers, Board of Agri- culture and Forestry.....	2,160.00	540.00	540.00	.....	.....
Salary of Superintendent of Animal Industry....	6,000.00	1,500.00	1,500.00	.....	.....
Pay of Assistants and Laborers, Division of Ani- mal Industry	6,760.00	2,655.12	1,770.69	884.43	.....
Totals ..	\$49,840.00	\$14,460.87	\$11,789.28	\$ 2,671.59	.....

CURRENT EXPENSES.

Act 127, Regular Session, 1907—					
Incidentals and General Expenses, Board of Agri- culture and Forestry.....	\$37,050.00	15,541.29	11,991.59	2,453.75	\$ 1,095.95
	\$86,890.00	\$30,002.16	\$23,780.87	\$ 5,125.34	\$ 1,095.95

**STATEMENT OF SPECIAL INCOME TAX FUND FROM JULY 1, 1909,
TO DECEMBER 31, 1910.**

CONSERVATION FUND.

Board of Agriculture and Forestry.

Allotments.

Allotment from July 1 to December 31, 1909, for six months, per month \$3,425.00.....	\$ 20,550.00
By special allotment, December 27, 1909.....	1,500.00
Allotment from January 1 to June 30, 1910, for six months, per month \$3,500.00.....	21,000.00
	<u>\$ 43,050.00</u>
Allotment from July 1 to December 31, 1910, six months, per month \$3,500.00	<u>\$ 21,000.00</u>

Expenditures.

	July 1, 1909, to June 30, 1910.	July 1, 1910. to Dec. 31, 1910.
Clerks and Stenographers.....	\$ 2,275.00	\$ 1,200.00
Employees and Laborers	1,144.50	1,863.50
Expenses all Divisions.....	16,449.61	5,850.15
Superintendent of Forestry.....	3,000.00	1,500.00
Assistants, Laborers, Etc., Forestry.....	5,322.56	3,307.84
Superintendent Entomology	3,000.00	1,500.00
Assistants, Etc., Entomology.....	5,291.00	2,406.45
Superintendent Animal Industry.....	3,000.00	1,500.00
Assistants, Etc., Animal Industry.....	3,369.64	1,850.00
Balance to credit of Board, from July 1, 1909, to June 30, 1910.....	\$ 42,852.31	\$ 20,977.94
	197.69	
Balance to credit of Board, from July 1, 1910, to Dec. 31, 1910.....		22.06
	<u>\$ 43,050.00</u>	<u>\$ 21,000.00</u>

Special Allotment.

Planting and Fencing of Pupukea-Paumalu Forest and Water Reserves ..	\$ 1,266.20
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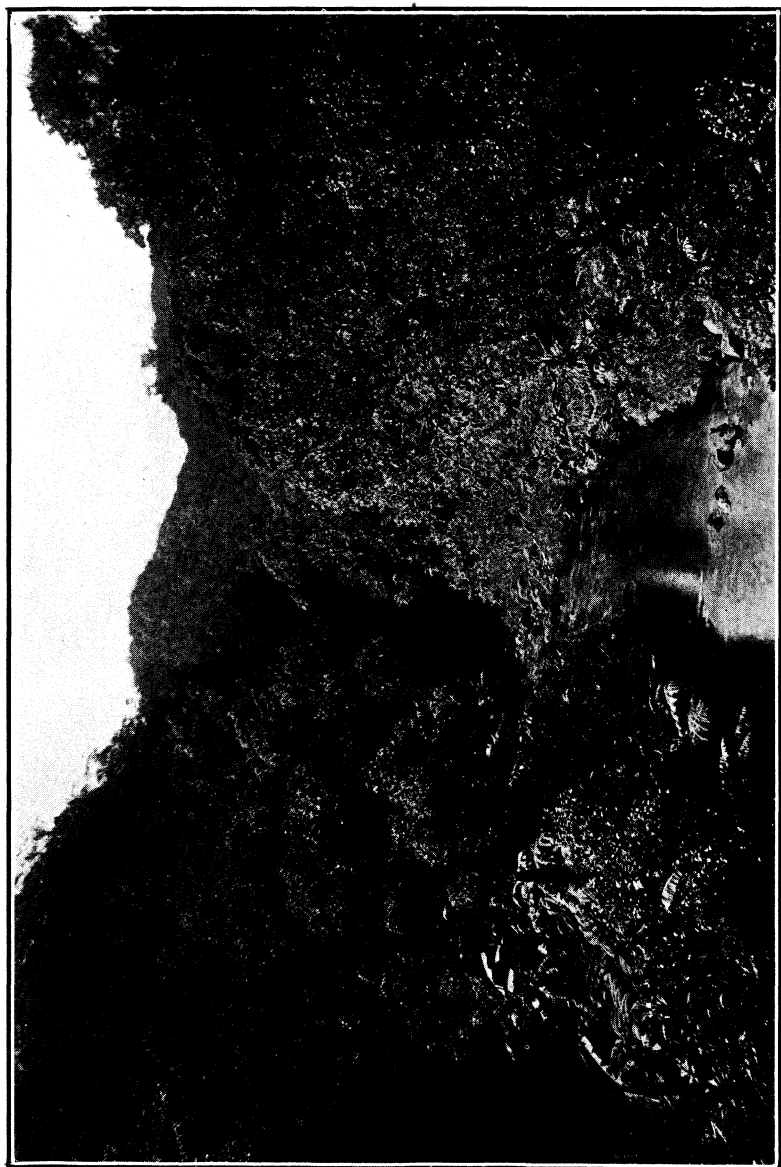


Plate 2. A Forest Cover Protects the Streams.

Photo by R. K. Bonine

Division of Forestry.

Report of the Superintendent of Forestry.

Honolulu, Hawaii, December 31, 1910.

The Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

GENTLEMEN:—I have the honor to present the report of the work of the Division of Forestry for the calendar years 1909 and 1910.

The function of an annual report is to set forth the accomplishments of the past year and to point the way to things that should be done in the future. During the period covered by the present report the progress of forestry in Hawaii has been steady and constant. There have been no spectacular achievements, but the passing months have been marked by evidences of a better appreciation of the reasons that lie behind forest work in these islands and a more general understanding of the intimate relation that exists between the right use of the forest and the maintenance of economic prosperity.

Far more than in most states, in Hawaii forestry is a matter of immediate practical concern to all the people of the Territory. Here, under unusual conditions of location, topography and climate the influence of the forest on the everyday life of the community is direct and easily seen. The prosperity of Hawaii depends on agriculture. Success in agriculture depends in turn upon irrigation—and without the aid of the forest it would be impossible to maintain a dependable water supply. These statements are axiomatic, but it does no harm to repeat them, for they are the reasons that underlie the local necessity for forestry and forest work.

Scarcely less important is the demand for wood. Here again the part of the forest is to supply a most practical want. In both instances the practice of forestry—be it by the Territorial Government or by private individuals or corporations—is founded on an economic need. This justifies the work. And because it does, it promptly raises the question in all thoughtful minds whether far-sighted wisdom does not demand a larger present investment for forestry. With larger appropriations far greater results would be obtained than with the present allotments are

possible of accomplishment. The purpose of this report is in part to answer this question, by showing in what ways the forest work could advantageously be expanded.

In Hawaii the forest work being done by the Territorial Government falls naturally under two main heads—the care of the existing native forests and the extension of a forest cover over areas that can be used to better advantage for growing trees than for any other purpose.

That the native forest may be managed in a way that shall make it of the greatest possible service to man, forest reserves are created and provision (at present altogether inadequate) made for their administration. Along with this goes a study of the forest from the botanical standpoint, for to manage our forests in the most efficient manner we must know more than we now do of the habits and characteristics of the various plants found therein.

Interest in tree planting naturally centers in the economic utilization of waste or barren areas not suitable for agriculture but which nevertheless can, if rightly managed, be made to yield supplies of wood and timber; but it also includes the introduction into the Territory of new and valuable kinds of trees and shrubs, and their systematic trial under various local conditions of climate and elevation.

In a Territory where so much of the forest work is being done under private auspices, the scope of a report like this must necessarily be broadened to include, as this does, not alone the work of the Division of Forestry but also an account of the general advance that has been made in forestry in Hawaii in the period covered.

Specifically the points of greatest forest interest during the past two years are the extension of the forest reserve system by the creation of seven additional reserves; the decided increase of interest in tree planting, especially as evidenced by the activity of a number of influential corporations in this direction; the wider observance of Arbor Day and the ready response that has followed the establishment of sub-nurseries for the local distribution of trees; a detailed study of the planted groves of Eucalypts, made through the coöperation of the Federal Forest Service; the continuation and extension of the plant introduction work; the resumption of forest planting by the Territorial Government itself; and the investigation of the native forest from the botanical standpoint.

Other special activities not directly connected with the branches of work listed above have also been prosecuted as far as opportunity and limited funds permitted. On the following pages is recorded what has been accomplished in these several ways during the past two years, with recommendations for the continuation and extension of the forest work.

During the summer of 1909 there was assigned to the Superintendent of Forestry the special duty of representing the Territory at the Seventeenth National Irrigation Congress, held at Spokane, Washington, with the object of agitating the question of the extension to Hawaii of the Federal Reclamation Act of June 17, 1902; a quest that was successful in so far as the securing of the passage of the desired resolution by that organization was concerned.

STAFF AND APPROPRIATIONS.

The regular staff of the Division of Forestry has remained unchanged during the past two years. It consists of the Superintendent of Forestry (Ralph S. Hosmer), the Forest Nurseryman (David Haughs), and the Botanical Assistant (Joseph F. Rock).

For a period of six months, from November, 1909, to May, 1910, Mr. Louis Margolin, Forest Examiner of the Forest Service of the U. S. Department of Agriculture, was detailed to Hawaii under a coöperative agreement between that Bureau and this Department, for an investigation of the Eucalyptus in Hawaii. During this time Mr. Margolin was on the payroll of the Board under the title of Forest Inspector.

One or two changes have been made in the staff of District Foresters and District Fire Wardens during the past two years. These are indicated in revised lists of these volunteer officials, given elsewhere in this report.

The period of this report covers parts of two biennial fiscal periods. During the six months from January to June, 1909, the allotment for the Division of Forestry from the general appropriation of the Board was at the rate of \$7,620.00 per annum for salaries and payrolls, and \$4,960.00 per annum for incidental and general expenses. Since July 1, 1909, all the expenses of the Board of Agriculture and Forestry have come from the Conservation Fund, raised by the special Immigration-Conservation Income Tax. The money for the Board of Agriculture and Forestry has been turned over as a lump sum; for the greater part of the time at the rate of \$3,500.00 a month. Of this sum the total allotment to the Division of Forestry has amounted, approximately, to \$14,000.00 per annum. Besides the above, \$5,000.00 was allotted by the Apportionment Board for forest planting on the Kohala mountains, Hawaii, and \$2,100.00 for fencing and forest planting at Pupukea, Oahu. Both these projects are now in progress.

FOREST RESERVES.

Since the establishment of the Division of Forestry, the building up of a forest reserve system has rightly held first place in its activities. In Hawaii, because these islands are an agricultural

community largely dependent on irrigation, the relation between continued economic prosperity and the right use of the forest is peculiarly intimate and direct. For this reason I consider it one of the essential duties of my office to continue to emphasize the principles that underlie the forest policy of the Territory to the end that they may be well and generally understood.

As I have pointed out in previous reports there are in Hawaii two main classes of forest, which for the sake of convenience may be termed the "water bearing forest" and the "commercial forest." The water bearing class consists at present almost exclusively of the native Hawaiian forests, situated for the most part in the windward districts, covering the watersheds and catchment basins of the streams that supply water for irrigation, power development and other economic uses. The chief value of this forest is that it protects the headwaters of these streams. Its most important product is water, and the treatment indicated for it is therefore the one which will best serve to produce the largest quantity of water. For the Hawaiian forest to render to the full its beneficial service as a conservator of water, it is essential that the forest cover be kept strictly intact, for owing to its character and composition it is easily damaged by the inroads of cattle and other enemies. The method of management best adapted to secure the result desired with this class of forest is to keep it as a "protection forest," from which men and animals are strictly excluded. Only by so managing it can it be made to yield permanently the largest share of its most valuable product, water.

The other main class, the commercial forest, includes two sorts of forest: (a) those sections of the native forest (for the most part in the districts on the leeward side of the Island of Hawaii) where from the nature of the topography and the remarkable porosity of rock and soil there are no permanently running streams and only occasional springs, and where, consequently, the problem of watershed protection does not enter; and, (b) the artificially introduced forests, like the belts of self-sown *Algaroba*, or the planted stands of *Eucalypts*, *Ironwoods* and other exotic trees. The value of the forests of the commercial class rests in the wood or timber that the forest can be made to produce, or in some special benefit it may render, as by forming a wind-break or shelterbelt for valuable agricultural land.

It should be said in this connection that of the total area of native Hawaiian forest the portion that can be classed as "commercial forest" is relatively small. Considered on the basis of area, or of money producing value, there is no comparison of the worth of the native Hawaiian forest for wood as against water. Wherever water is to be obtained, it is the chief and most important product of the Hawaiian forest. A very large percentage of all the now existing Hawaiian forests belongs to the water bearing class. This area should, for that reason be

managed as protection forest. The real importance of the commercial class of forest as a source of wood will, as time goes on, more and more rest in the planted stands of Eucalypts and other introduced forest trees.

Both the water bearing and the commercial classes of forest are of great practical importance to this Territory. But from their very nature the two classes require radically different treatment. In the one case the important product is water; in the other, wood. Each class should be so cared for and administered that it will yield, permanently, as large a share of its most valuable product as may be. If it is of the water bearing class it should be made to yield as much water as possible, in as regular and equalized a flow as local conditions will permit. This means in practice that the forests of the water bearing class should be managed as protection forests, and kept as nearly as possible in their primitive state. If, on the other hand the forest is of the commercial class, it should be so managed that one crop of trees will be made to follow another in regular order.

These considerations are at the basis of the whole forest system in Hawaii. It is because the forest can be made the better to do its duty by being systematically cared for that forest reserves are set apart and the agitation for their better administration continued. Considerable forest area in Hawaii has now been technically declared reserved, but up to the present but scant heed has been paid properly to taking care of this area. Until adequate provision is made for protecting the forest reserves from injury by fire, animals and trespass, the Hawaiian forests cannot be made to serve to the full the objects for which the reserves are created.

Two years ago I pointed out that the essential needs were money for fencing such stretches of forest reserve boundaries on government land as cannot be provided for through fencing requirements in leases of adjoining government tracts; a fund from which expenses for fighting forest fire on government land could be paid, in times of necessity; and an appropriation sufficient to permit the employment of forest rangers to see that the forest reserve boundaries are maintained and respected, to prevent trespass by animals and men, to protect the forest reserves from fire, and in general to give the forest the care it requires if it is to be made of the greatest service to man. Along with this in some of the reserves there is need of forest planting to fill out blanks in the cover and repair damage done through the opening up of the forest in former years.

The experience of the past two years only accentuates the arguments put forth at that time. Until the boundaries of the reserves are fenced, where they are not in themselves natural barriers, and until there is provision made for the protection of the forest against fire and trespass, the Hawaiian forest will not

render to the people of the Territory the duty that it ought. To provide these things costs money; but such an outlay is as surely an investment as if the money were put out at interest with a banking house. The returns from forest protection, both direct and indirect, will amply repay the money advanced in the beginning. The protection and wise management of the forest is a fundamental need in Hawaii. It is the duty of this Board to make the people of the Territory so to realize this fact that they will make adequate provision for carrying on the necessary work.

NEW RESERVES.

During the calendar year 1909 four new forest reserves were set apart by proclamation by the Governor, aggregating a total area of 101,614 acres, of which 83,234 acres—82 per cent.—is government land.

In 1910 three more reserves were created, bringing the total up to twenty-three. The 1910 reserves aggregate 29,132 acres, all government land. The gross area of the twenty-three forest reserves so far established is 575,154 acres, of which 386,547 acres, 67 per cent., is land belonging to the Government.

The list of new reserves is as follows:

Name.	District.	Island.	Date
	1909.		Proclaimed.
Mauna Kea.....	Hamakua.....	Hawaii.....	June 5, 1909
Waihou Spring.....	Hamakuapoko....	Maui.....	June 5, 1909
Lihue-Koloa.....	Puna and Kona...	Kauai.....	June 5, 1909
Molokaa.....	Koolau.....	Kauai.....	June 5, 1909
	1910.		
Pupukea.....	Koolauloa.....	Oahu.....	May 10, 1910
Hauola.....	Hamakua.....	Hawaii.....	June 13, 1910
Kahoolawe.....	Maui County.....	Kahoolawe.....	Aug. 25, 1910

On following pages are tables showing full data in regard to these and earlier established forest reserves, arranged both chronologically and by islands. Detailed reports in connection with each reserve are made and submitted to, and approved by the Board at the time of the setting apart of the reserve. These reports later appear in the Hawaiian Forester and Agriculturist.

Object of Certain Reserves.

Of the new reserves it may briefly be noted here that the primary object in the creation of four of them—Waihou Spring, Lihue-Koloa, Molokaa and Pupukea—was, in common with most of the reserves that have heretofore been set apart, to secure better protection for the forest cover on important water sheds. The reservation of Mauna Kea and Kahoolawe involves a somewhat different principle. These tracts are non-water-bearing and

both contain considerable areas of land not now under forest, nor indeed covered by any useful sort of vegetation.. In both these cases the object of setting the lands apart as forest reserves is to facilitate the taking of measures that in the end will make them of greater value to the people of the Territory—on Mauna Kea by establishing a forest of economically valuable trees on what is now classed only as waste land; on Kahoolawe through the reclamation of that island by establishing a cover of vegetation to replace the former cover that has largely been lost through continued mismanagement. Work of this character can best be handled by the Territorial Government through the Board of Agriculture and Forestry. The setting apart of these lands as forest reserves transfers their control to this Department and makes it possible to undertake their systematic development at any time when funds may become available. In the mean time experimental work can be started and carried on to better advantage than if these tracts were merely public lands subject to constant change of status.

The island of Kahoolawe is still under lease—the term of the expiring lease not running out till January 1, 1913, at which time the reservation becomes effective. The setting apart of the island took place this year that there may be no question as to the intentions of the government when the term is up. This action is in accord with one of the recommendations of a concurrent resolution (House, No. 19) adopted by the Legislature at the Session of 1909. Arrangements are now being perfected whereby the work of reclaiming Kahoolawe can be begun in a small way at once. Work on a larger scale must necessarily, and should, await the completion of forest work in certain other more important localities.

Minor Changes in Forest Reserves.

It is proper to note here one modification of a forest reserve boundary, whereby the area of the Makawao Forest Reserve on Maui is increased from 1,796 to 1,830 acres. This change will facilitate the better protection of that reserve when it becomes possible, as I trust it will in the near future, to fence it off. The proclamation effecting this change of boundary was signed by Governor Frear on June 5, 1909. Also, that on August 25, 1910, Governor Frear signed proclamations setting apart certain government forest lands in the Hilo, the Kau, the West Maui and the Ewa Forest Reserves—tracts lying within the established limits of those reserves but not technically set apart when those reserves were created, because of having at that time been under lease. This action removes a possible cloud as to the legal status of these forest reserves.

FOREST RESERVES, TERRITORY OF HAWAII.

Arranged in Chronological Order.

(Corrected to February 10, 1911.)

No.	Name.	District.	Island.	Total Area Recom- mended to be Reserved.	Area Gov- ernment Land.	Area Private Land.	Date of Proclamation.	Proclamation Signed by
				Acres.	Acres.	Acres.		
1	Kaipapau.....	Koolauloa	Oahu	913	913	.....	Nov. 10, 1904	G. R. Carter
2	Hamakua Pali. Hamakua	.....	Hawaii	18,940	16,333	2,607	Dec. 23, 1904	"
	Total for the year ending December 31, 1904.....			19,853	17,246	2,607		
3	Hilo.....	Hilo	Hawaii	110,000	60,223	49,777	July 24, 1905	A. L. C. Atkinson
4	Koolau, Maui..	Koolau and Hamakualoa.....	Maui	42,969	30,230	12,739	Aug. 24, 1905	"
5	Halelea.....	Halelea	Kauai	37,500	10,990	26,510	Aug. 24, 1905	"
	Total for the year ending December 31, 1905.....			190,469	101,443	89,026		
6	Kealia.....	Puna	Kauai	9,935	7,385	2,550	Mar. 9, 1906	"
7	Ewa.....	Ewa, Waianae and Waialua.	Oahu	28,550	5,151	23,399	Mar. 9, 1906	"
8	Honouliuli.....	Kona	Hawaii	665	665	.....	April 4, 1906	"
9	Kau.....	Kau	Hawaii	+ 66,066	59,811	6,255	Aug. 2, 1906	G. R. Carter
10	Waianae-kai.....	Waianae	Oahu	3,257	3,150	107	Sept. 7, 1906	"
11	Luahalei.....	Waianae	Oahu	3,743	3,743	.....	Nov. 30, 1906	"
12	Hana.....	Hana	Maui	14,825	13,767	1,058	Nov. 30, 1906	"
	Total for the year ending December 31, 1906.....			127,041	93,672	33,369		
13	Na Pali-Kona..	Na Pali and Kona.....	Kauai	60,540	40,650	19,890	June 12, 1907	A. L. C. Atkinson
	Total for the year 1907.....			60,540	40,650	19,890		

14	West Maui.... Lahaina, Kaanapali and Wai- luku	Maui	\$ 44,482	19,147	25,335	April 21, 1908	W. F. Frear
15	Makawao..... Hamakuapoko	Maui	* 1,830	1,830	.....	April 21, 1908	"
16	Waiaha Spring, Kona	Hawaii	193	193	.....	April 21, 1908	"
Total for the year ending December 31, 1908.....			46,505	21,170	25,335		
17	Mauna Kea.... Hamakua	Hawaii	66,600	66,600	.....	June 5, 1909	"
18	Waihou Spring, Hamakuapoko	Maui	84	74	10	June 5, 1909	"
19	Lihue-Koloa... Puna and Kona	Kauai	29,260	12,945	16,315	June 5, 1909	"
20	Molokaa..... Koolau	Kauai	5,670	3,615	2,055	June 5, 1909	"
Total for the year ending December 31, 1909.....			101,614	83,234	18,380		
21	Pupukea..... Koolauloa	Oahu	865	865	.....	May 10, 1910	"
22	Hauola..... Hamakua	Hawaii	7	7	.....	June 13, 1910	E. A. Mott-Smith
23	Kahoolawe..... County of Maui.....	Kah'lawe	28,260	28,260	.....	Aug. 25, 1910	W. F. Frear
Total for the year ending December 31, 1910.....			29,132	29,132	.....	
Grand Total, February 10, 1911.....			575,154	386,547	188,607		
				[67%]	[33%]		
<hr/>							
* Boundary modified and area enlarged from 1,796 to 1,830 acres, by proclamation of Gov. Frear, June 5, 1909.							
\$	"	"	44,482 to 44,482	"	"	"	February 4, 1911
"	"	"	65,850 to 66,066	"	"	"	February 4, 1911
†	"	"					

FOREST RESERVES, TERRITORY OF HAWAII.

Arranged by Islands and Counties.

(Corrected to February 10, 1911.)

No.	Name.	District.	Island.	Total Area Recom- mended to be Reserved.	Area Gov- ernment Land.	Area Private Land.	Date of Proclamation.	Proclamation Signed by
COUNTY OF KAUAI.								
				Acres.	Acres.	Acres.		
5	Halelea.....	Halelea	Kauai	37,500	10,990	26,510	Aug. 24, 1905	A. L. C. Atkinson
6	Kealia.....	Puna	Kauai	9,935	7,385	2,550	Mar. 9, 1906	"
13	Na Pali-Kona...	Na Pali and Kona.....	Kauai	60,540	40,650	19,890	June 12, 1907	"
19	Lihue-Koloa...	Puna and Kona.....	Kauai	29,260	12,945	16,315	June 5, 1909	W. F. Frear
20	Molokaa.....	Koolau	Kauai	5,670	3,615	2,055	June 5, 1909	"
Total for Kauai.....				142,905	75,585	67,320		

COUNTY OF OAHU.

1	Kaipapau.....	Koolauloa	Oahu	913	913	.....	Nov. 10, 1904	G. R. Carter
7	Ewa.....	Ewa, Waianae and Waialua.....	Oahu	28,550	5,151	23,399	Mar. 9, 1906	A. L. C. Atkinson
10	Waianae-kai.....	Waianae	Oahu	3,257	3,150	107	Sept. 7, 1906	G. R. Carter
11	Lualualei.....	Waianae	Oahu	3,743	3,743	.....	Nov. 30, 1906	"
21	Pupukea.....	Koolauloa	Oahu	865	865	.....	May 10, 1910	W. F. Frear
Total for Oahu.....				37,328	13,822	23,506		

FOREST RESERVES PENDING.

It has been stated in earlier reports that it is the intention of the Territorial Government ultimately to include within the boundaries of its forest reserves a gross area of approximately three quarters of a million acres, of which about 70 per cent. will be government land. A number of important units still wait formally to be set apart, although all but the final steps have been taken in most of these projects.

Four projects in particular are the proposed forest reserves in South Kona, Hawaii; Kohala Mountain, Hawaii; the upper part of the Kula District, Maui; and the upland of Molokai. These areas will unquestionably be set apart as reserves early in 1911. Large portions of the areas both on Kohala Mountain and on Molokai have in practice been actual reserves for a number of years, maintained under fence and protected through the interest of private corporations.

With the setting apart of these areas and a few smaller tracts on Maui, Hawaii and Oahu, the formal creation of a forest reserve system in Hawaii will have been practically accomplished. But as has many times before been pointed out, the technical reservation of forest land is but the first step toward its efficient management. The next move can and will be made as soon as the Legislature provides the funds with which to go ahead.

PLANTING IN FOREST RESERVES.

Under special allotments made by the Apportionment Board from the Conservation Fund, the Territorial Government has started forest planting in two localities—the Pupukea Forest Reserve on Oahu and Kohala Mountain, Hawaii. At Pupukea under a contract with Mr. C. G. Owen, 25,000 trees—Eucalyptus, Monterey Cypress and Japanese Cedar—have been planted on approximately 35 acres, on the portion of the forest reserve formerly known as “Water Reserve C;” the area planted being the sides of gulches and a small flat above certain springs that are to be used for the domestic supply of the Pupukea Homesteaders. Seedlings were shipped from the Government Nursery at Honolulu. The trees are spaced 8x8 feet, or 680 to the acre. The planting began in March and was continued at intervals during the early summer. Part payment was made after the trees were planted; the remainder of the contract price will be paid when the trees reach a height of three feet.

For planting on the Kohala Mountain the sum of \$5,000. was allotted, which has been met by an equal amount by the Parker Ranch. This money was not available till December 1, 1910; consequently no trees have yet been put into the ground, but a goodly number are being made ready at nurseries at Waimea. These will be planted early in 1911.

The area where the planting is to start is immediately above Waimea Village, above and including the upper end of the Puukapu Homestead Tract, on a slope of the Kohala Mountain that is tributary to springs from which water is piped down to the plains below. The area to be planted under the auspices of the Ranch is the adjoining fee simple land. Together the two tracts will make a continuous block.

FOREST FENCE AT PUPUKEA.

In this connection mention may be made of the construction by contract during the summer of 1910 of about a mile and a half of forest fence on the outside boundaries of the Pupukea Forest Reserve, Oahu, to keep cattle out of the woods. The cost of this fence was borne jointly by this Board and the Ranch Department of the Oahu Railway and Land Co.

In several localities stretches of forest fence have been built along forest reserve boundaries, or in places where a fence shuts off access to the reserve, by sugar plantation companies and other private corporations. If there were a regular fencing fund available so that the Government could coöperate with corporations in the cost of fencing, as well as build fences itself, it would be possible to secure the construction of many miles of fence in places where it is very much needed.

CONDEMNATION OF FOREST LAND ON KOHALA MOUNTAIN.

Following a thorough investigation of the question and several abortive attempts to get something done in the matter of the actual reservation of the forest at the north-west end of the Kohala Mountain, the Board finally succeeded in getting the Sugar Plantation Interests of the Kohala District to contribute a substantial sum to be used for the purchase of certain privately owned forest lands of strategic importance in the proposed Kohala Mountain Forest Reserve. Twenty-four thousand dollars was raised in this way, especially with the idea of securing the forested portion of the land of Kehena 2 lying to the east of the Hooleipalaoa gulch, belonging to the Estate of the late James Woods, Esq. The money was contributed on the understanding that the Territory should fence and where necessary, plant the area acquired; this to be done upon the transfer of the fee to the Government. Failing to come to terms with the trustees of the Woods Estate, the Government, in the autumn of 1910, instituted condemnation proceedings to acquire the land by eminent domain. The case has not yet come to trial. In the meantime, pending the adjustment of this matter, the project of setting apart the Kohala Mountain Forest Reserve has been temporarily held up.

FOREST EXTENSION.

Forest Extension embraces the activities of the Division of Forestry in growing and distributing trees, including the special free distribution on Arbor Day, the giving of advice and assistance to individuals and corporations regarding tree planting, and the introduction and trial of trees and shrubs new to the Territory. This section of the Division's work comes under the immediate charge of Mr. David Haughs, the Forest Nurseryman, in whose report will be found a detailed account of the results accomplished during the past two years. It is not the intention here to repeat the statements made by Mr. Haughs, but it is pertinent to give space to certain general observations on matters not specifically covered in his report.

ASSISTANCE TO FOREST PLANTERS.

One of the most important branches of the work of the Division of Forestry is the assistance given to individuals and corporations desiring to undertake forest work of one and another sort. This help is rendered in two ways: first, by advice as to how to accomplish the results desired; and second, by the growing and furnishing of seedling plants and of seed at cost price. If there were some graphic way of showing the effort expended in this direction, this chapter of the report would contain a very interesting series of charts and diagrams. As it is, it may be stated that scarcely a day passes but that anywhere from one to half a dozen persons are given definite, practical directions about the planting or care of trees, or concerning other matters germane to the work of this office. This advice is given in personal interviews, by letter, or in the case of more important work, by carefully prepared reports, the result of a personal inspection on the ground, outlining in detail the recommendations made.

Among the more important forest planting plans prepared during the past two years were reports for the Molokai Ranch Company, the Lanai Company, and for the planting on Kohala Mountain, to be done jointly by the Government and the Parker Ranch—drawn up by the Superintendent of Forestry; and for the Kukaiau Plantation Company, the Pioneer Mill Company, and the Waialua Agricultural Company, prepared by the Forest Nurseryman. All of these plans are being carried into effect, in whole or in part.

In October, 1909, there was issued a revised edition of the press bulletin of the Division of Forestry giving directions in regard to tree planting. This little pamphlet has been much in demand. It was printed both in English and in Hawaiian—another instance where the Board has endeavored to follow the

recommendations of the last Legislature as made in a concurrent resolution, already referred to.

On the side of furnishing actual material for planting, more forest tree seed and more seedling plants have gone out from the Government Nursery this last year than ever before, not to speak of the plants distributed from the sub-stations. The combined total of trees distributed from all the government stations, including those sold and those given away on Arbor Day and at other times, is 112,590 for 1909 and 264,573 for 1910.

Recently several sugar plantation companies have been supplied with seedling trees in seed boxes, just ready for the first transplanting. As the greatest losses in tree growing are caused by the damping off fungus, which works in the very early stages of the tree's life, this arrangement has given general satisfaction, because when the little trees are large enough to transplant they have passed the period of danger. The price of seedlings varies with the species, but in all cases is only enough to cover the cost. It should be noted here that when large numbers of trees are wanted, orders must be placed well in advance. It takes from two to four months to grow the seedlings to a size large enough to send out. It is neither practicable nor advisable for this Nursery to keep on hand large quantities of seedlings, but upon due notice all reasonable demands will be complied with.

Reference has already been made under the heading Forest Reserves to the planting of government land at Pupukea, Oahu, and on Kohala Mountain. This is a branch of work to which it is hoped there will be reason to give much more space in future reports. Specifically the areas that are most in need of forest planting are the Kohala Mountain, Hawaii, Polipoli Spring Reserve and portions of the upper Kula slopes, Maui, and the Pupukea Forest Reserve, Oahu. Experimental planting should be undertaken on certain of the government lands on the windward side of Maui, in the Koolau Forest Reserve, in the areas where the native forest died out a few years since; and also in the Makawao Forest Reserve, above Kailiili—a locality that offers exceptional advantages for the trial of timber trees new to the Territory. There is no lack of other places that ought also to be planted if only funds were available.

Along with the forest planting here recommended every effort should be made to extend the limits of the Algaroba forest, especially along the lee shores of the several islands. This valuable tree will grow if given half a chance. Its spread ought systematically to be assisted, both by the Government and by private interests.

THE ESTABLISHMENT OF SUB-NURSERIES.

To meet the constantly growing demand for trees for forest and other planting, and especially that homesteaders and other

small land holders may readily be supplied, it is the definitely announced policy of the Board of Agriculture and Forestry to establish and maintain sub-nurseries and distributing stations on each of the larger islands of the group.

The Nursery at Homestead, Kauai.

There are now two regular sub-nurseries with paid employees; at Homestead (Kalaheo), Kauai, and at Hilo, Hawaii. In both places the success of the undertaking is due to the generous coöperation of gentlemen who, making tree growing their principal avocation, have been willing to oversee the work of the laborers paid by the Division of Forestry and to put into execution the general plan laid down by this office.

The Nursery at Homestead was established in October, 1908, when one laborer was provided to work under the direction of Mr. Walter D. McBryde, the local District Forester. Some additional labor, with a few tools, pots and other supplies for the Nursery have been furnished from time to time during the past two years. The following tabulation shows the number of trees given out from this Nursery during 1909 and 1910:

TREES DISTRIBUTED FROM HOMESTEAD NURSERY.

1909.	Arbor Day:		
	Called for at nursery.....	2,575	
	Sent away	522	3,097
		<hr/>	<hr/>
1910.	January to June.....		6,711
	June to December.....		3,240
	Arbor Day:		
	Called for at nursery.....	2,333	
	Sent away	300	2,633
		<hr/>	<hr/>
	Grown for planting in Papapaholahola Reserve....		3,665
	Sold		6,000
		<hr/>	<hr/>
	Total for 1910.....		22,249

It is only just that the hearty thanks of the Division of Forestry should here officially be given to Mr. McBryde for his zeal and unflagging interest in making the Nursery at Homestead the success that it unquestionably is.

As has elsewhere been noted, Mr. McBryde has done much private tree planting during the past five years, more particularly on the prominent hill top makai of Homestead, which he has christened "Kukuilono Park." On Arbor Day 1909, he planted 6,000 trees there, mainly Eucalypts; and during 1910 he has set out 13,298 more, bringing the total of trees planted on the hill up to 36,540.



Plate 3. *Eucalyptus robusta* on Tantalus.



Plate 4. *Eucalyptus citriodora* in the Tantalus Forest.

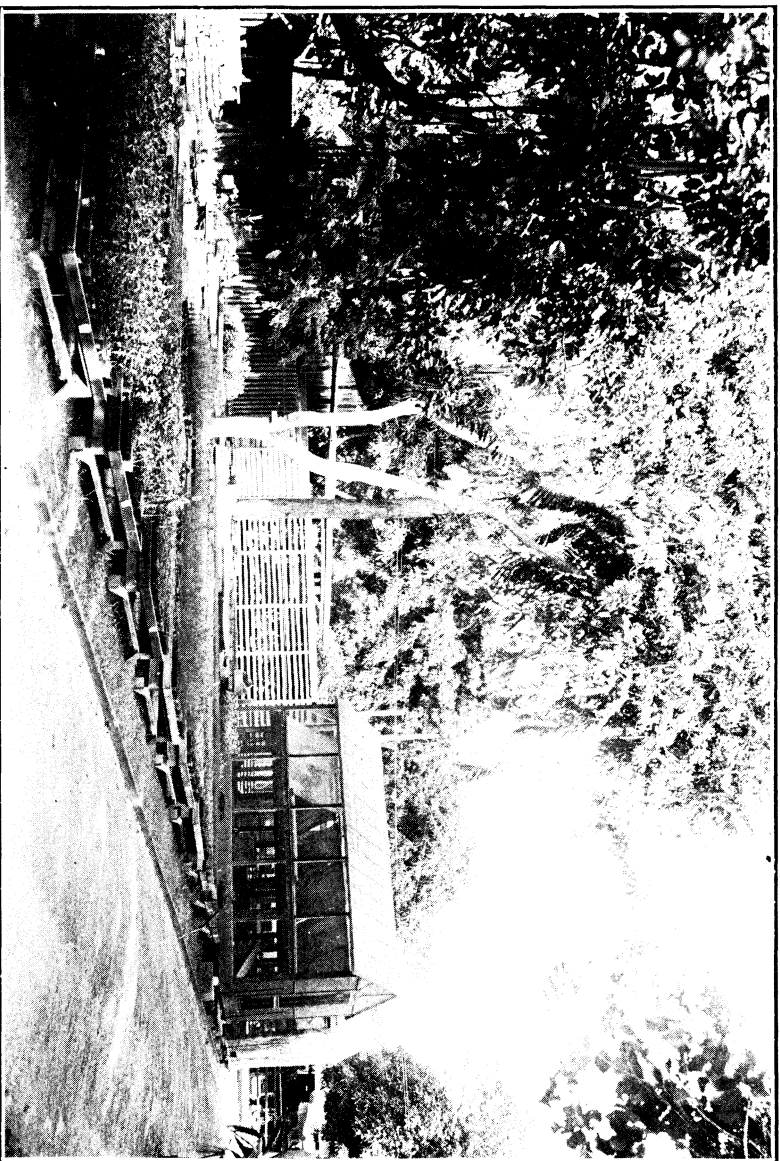


Plate 5. The Government Nursery, Honolulu.

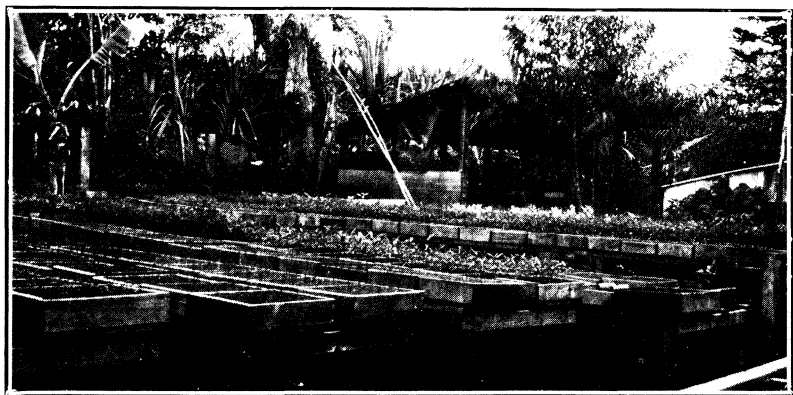


Plate 6. Views of the Hilo Nursery.

The Hilo Nursery.

The Nursery at Hilo is under the direct charge of Bro. Matthias Newell, principal of St. Mary's School for Boys. For a long time Bro. Matthias, with the aid of his pupils, has been growing trees and other plants and distributing them to people in and about Hilo. In 1910 the Division of Forestry was able to supply a regular laborer and in part to equip the Nursery with much needed supplies. Prior to 1910, Bro. Matthias did a large share of the nursery work with his own hands, putting in at the Nursery the greater part of the scant time that is his personally after attending to the duties of his office. Bro. Matthias modestly refuses even to tell the story of the Nursery in his own words, but the people whom he serves in Hilo do not need to be reminded of his good works.

During the past year special attention has been paid to distributing trees from the Hilo Nursery to schools and to homesteaders all the way from Laupahoehoe to the Volcano House, and large numbers of trees have been placed where they are most needed. In this distribution the Hilo Railroad Company, through its Superintendent, Mr. R. W. Filler, and the Volcano Stables and Transportation Company, through its manager, Mr. C. E. Wright, have helped much by carrying many lots without charge.

Following is a statement of the plants given out from the Hilo Nursery during 1909 and 1910:

TREES DISTRIBUTED FROM HILO NURSERY.

1909.	Arbor Day	3,500
1910.	January to June.....	2,120
	July to Arbor Day.....	9,459
	Arbor Day to December 31.....	7,580
	Total for 1910.....	19,159

Temporary Distributing Stations.

While lack of funds has prevented the establishment of other regular sub-nurseries, the Division of Forestry has been fortunate in being able to arrange with the managers of several sugar plantation companies and other gentlemen to grow trees at cost price for local distribution, especially in connection with Arbor Day. Those who most actively coöperated in this way were Messrs. L. Weinzheimer, Lahaina; H. B. Penhallow, Wailuku; D. T. Fleming, Paia; L. von Tempsky, Makawao (in 1909); and John Chalmers, Hana, all on the island of Maui; and Messrs. G. C. Watt, Kohala, and A. W. Carter, Waimea, Hawaii. A

number of other persons have helped distribute shipments of trees sent from Honolulu. It should be added, too, that many of the sugar plantation companies and other corporations having nurseries of their own make a practice of giving away trees to homesteaders and others in their vicinity. Prior to Arbor Day, notices of the free distribution of two dozen trees each to every applicant, in English, in Hawaiian and in Portuguese, were given wide publicity throughout the Territory—so that any one who really wanted trees has only himself to blame if he did not get them.

On Maui and on Oahu trees for roadside planting have, upon request, been supplied free to the County officials. With the establishment of more sub-nurseries it is hoped that this branch of the work can be extended.

ARBOR AND CONSERVATION DAY.

Interest in Arbor Day has steadily increased. In his proclamation in 1909, Governor Frear gave the observance of the day a wider scope by terming it "Arbor and Conservation Day," a usage which was repeated this last year. In almost all the schools appropriate exercises are now held each November, with considerable enthusiasm. It is to be regretted that not as much can be said of the success of the trees that have been set out. It takes a long time to impart the obvious Arbor Day lesson that to make a tree grow requires something more than to stick it in the ground. But there is a gradual gain, which makes the effort worth while.

As in former years the Board of Education has coöperated with this Department by paying the freight charges on Arbor Day shipments, as well as in other ways. The Arbor Day exercises in the schools were made more interesting and varied both in 1909 and 1910 by the efforts of the Women's Clubs, which have taken up this work in an earnest and active way, furnishing speakers at many schools and helping to devise attractive programs elsewhere.

In this connection mention may well be made of the wide spread and genuine interest in Conservation that has been manifested by several organizations of women in this Territory, notably by the Hawaii Branch of the Woman's National Rivers and Harbors Congress and by the Conservation Committees of the Hawaii Chapter of the Daughters of the American Revolution and the College Club of Honolulu. Among other things prizes have been offered in a number of schools for essays on Conservation, and various meetings held at which creditable papers have been presented dealing with Conservation and Forestry.

Statistics of Arbor Day Distribution.

The following table shows for the past two years the number of trees given out for Arbor Day planting. In 1908 Arbor Day trees were distributed only from the Government Nursery at Honolulu; 15,703 were given out.

FREE DISTRIBUTION OF TREES FOR ARBOR DAY PLANTING.

1909.

Government Nursery, Honolulu—

Schools	4,452	
Churches	3,858	
Public	33,467	
		41,777

Subnurseries.

Homestead Nursery, Kauai.....	3,097
Hilo Nursery, Hilo, Hawaii.....	3,500

Temporary Distributing Stations.

Haleakala Ranch Nursery, Makawao, Maui.....	4,577
Wailuku Sugar Co.'s Nursery, Wailuku, Maui.....	1,163
Kaeleku Sugar Co.'s Nursery, Hana, Maui.....	8,000
Parker Ranch Nursery, Ahualoa, Hawaii.....	1,500

Total for 1909.....	63,614
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1910.

Government Nursery, Honolulu—

Schools	3,003	
Public	5,068	
		8,071

Subnurseries.

Homestead Nursery, Kauai.....	2,633
Hilo Nursery, Hilo, Hawaii.....	7,000

Temporary Distributing Stations.

Wailuku Sugar Co.'s Nursery, Wailuku, Maui.....	2,345
Paia Agricultural Co.'s Nursery, Paia, Maui.....	1,881
Kaeleku Sugar Co.'s Nursery, Hana, Maui.....	5,000
Kohala Sugar Co.'s Nursery, Kohala, Hawaii.....	3,000
Ahualoa Nursery, Honokaa, Hawaii.....	552

Total for 1910.....	30,482
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The very considerable difference in the number of trees given out for Arbor Day 1910 as against 1909, is accounted for by the fact that in 1909 considerable shipments of tree seedlings in transplant boxes were made to several homestead tracts, notably Kau, Hawaii, Pupukea, Oahu, and Palolo and Alewa Heights, Honolulu—the people at these places receiving, through special arrangement, a larger number of trees than the two dozen usually given to a single applicant. Getting enough trees at that time to

do what planting they desired to, these persons have not applied again. It will be noticed in this connection that the difference in the two years is mainly in the number given out from Honolulu. The establishment of sub-nurseries on the other islands, from which persons in the vicinity can get trees at any time, has also tended to reduce the number of applications sent in to Honolulu for this special distribution.

TREE PLANTING BY CORPORATIONS.

One of the most important evidences of the progress of forestry in Hawaii is the growing interest that is being taken in tree planting throughout the Territory, both on a small scale by individuals and in the establishment by certain of the larger corporations of regular forest plantations.

As being of general interest for purposes of comparison, the Division of Forestry has compiled a table giving statistics of tree planting in Hawaii during the past two years. This appears on the following pages. Comparing the totals of trees planted with those given in earlier reports (especially the report of the Division of Forestry for 1908, pp. 27 and 28) it will be seen that there has been a marked gain. The grand totals for the last three years are as follows:

Total Number of Trees Reported Planted.

1908.	1909.	1910.
498,677	597,381	725,022

It is, of course, to be understood that this table is merely a record of trees planted and not of forest planting as such. The various entries include trees planted for windbreaks and shelterbelts, for stock shelters, for ornamental purposes, and along roadsides, as well as plantations made with the object of watershed protection and direct commercial return. It is nevertheless of interest as showing the large number of trees set out. While naturally not all of the seedlings listed will live to become mature trees, it is believed that the greater part of the planting covered by this table was done under conditions that insure the trees doing well. In such a table there must, almost necessarily, be some omissions, but it is believed all the more important projects are included. The figures given were for the most part supplied by the corporations doing the work. Those otherwise obtained are, if anything, over-conservative. The table does not include school ground planting, nor with the exception of the Homestead planting in Kau, Hawaii, the many small lots of trees set out by individuals. Taken by and large a record of seven hundred and twenty-five thousand trees planted in one year is not a bad showing:

TABLE SHOWING NUMBER OF TREES PLANTED IN THE TERRITORY OF HAWAII, MAINLY BY CORPORATIONS, IN 1909 AND 1910.

Kauai.		
Name of Corporation.	1909.	1910.
Kilauea Sugar Plantation Co.....	.....	200
Makee Sugar Co.....	.....	4,400
Lihue Plantation Co.....	20,000	25,000
Grove Farm	20,000	22,000
Koloa Sugar Co.....	3,500	5,500
Hawaiian Sugar Co.....	.....	10,000
W. H. Rice.....	.....	14,000
W. D. McBryde (Kukuiohono Park).....	12,000	13,298
Papapahohola Reserve	1,000	3,665
Totals for Kauai.....	56,500	98,063
Oahu.		
Laie Plantation	700	1,200
Kahuku Plantation Co.....	2,000	2,000
Waialua Agricultural Co.....	6,980	31,212
Waianae Co.....	9,408	6,287
Oahu Plantation Co.....	.....	200
Honolulu Plantation Co.....	.....	14,200
Hawaiian Pineapple Co.....	36,294	.....
Hawaiian Development Co.....	19,000	19,000
Ii Estate (Waipio).....	29,575	30,000
Kunia Development Co.....	600	16,000
Dowsett Co. (Nuuanu).....	.....	1,200
W. R. Castle (Tantalus).....	1,000	1,000
O. R. & L. Co. Ranch Department.....	.....	6,000
C. G. Owen (Pupukea).....	.....	2,000
Pupukea Forest Reserve.....	.....	25,000
County Road Boards.....	.....	6,000
Totals for Oahu.....	105,557	161,299
Maui and Molokai.		
Kaeleku Sugar Co.....	.....	600
Maui Agricultural Co—		
Kailili and Opana.....	142,705	95,034
Paia Nursery	23,000	40,000
Hawaiian Commercial & Sugar Co.....	500	2,270
Wailuku Sugar Co.....	13,855	18,987
Pioneer Mill Co.....	6,000	10,000
Haleakala Ranch	19,514	11,300
Honolua Ranch	300	.....
Country road planting.....	1,200	2,300
Molokai.		
Molokai Ranch .....	.....	2,000
Kalawao and Kalaupapa.....	6,000	8,116
Totals for the County of Maui.....	212,874	190,607

Hawaii.

Niulii Mill & Plantation.....	750	2,050
Kohala Sugar Co.....	24,000	20,500
Hawi Mill & Plantation Co.....	500	1,000
Parker Ranch .....	.....	15,733
Pacific Sugar Mill.....	2,700	2,000
Laupahoehoe Sugar Co.....	.....	120
Paauhau Sugar Plantation Co.....	30,000	10,000
Hamakua Mill Co.....	60,000	100,000
Kukaiau Plantation Co.....	100,000	110,000
Olaa Sugar Co.....	.....	300
Hawaiian Agricultural Co.....	3,500	6,500
Kapapala Ranch	1,000	650
Homesteaders in Kau.....	.....	5,000
Huehue Ranch .....	.....	1,200
Totals for Hawaii.....	222,450	275,053

SUMMARY BY ISLANDS.

(Showing also totals for 1908.)

	1908.	1909.	1910.
Kauai ..	58,925	56,500	98,063
Oahu ..	42,802	105,557	161,299
Maui ..	197,518	212,874	190,607
Hawaii ..	199,432	222,450	275,053
	<u>498,677</u>	<u>597,381</u>	<u>725,022</u>

It would be invidious to single out any one corporation for special praise in tree planting, but it is proper to make this general note of those that are most active in establishing real forest plantations, as distinguished from windbreak, stock-shelter or ornamental and roadside planting.

For many years now the Lihue Plantation on Kauai has been adding annually block after block to its extensive Ironwood forest. Mr. G. N. Wilcox, at Grove Farm, Lihue, has also been starting true forest plantations, while on Kukuiohono Hill at Kalaheo, Mr. Walter D. McBryde has in the past three years planted a close set forest now numbering 36,540 trees.

On Oahu, the last two years have seen systematic forest planting on a considerable scale got well under way by the Waialua Agricultural Company. The Waianae Company, the Honolulu Plantation and the Ii Estate are also doing true forest planting on this island.

On Hawaii the Kohala Sugar Company and the Parker Ranch have of late done more than others in this direction, though several of the sugar plantations along the windward coast have planted groves for fuel wood supply, as well as for windbreaks, in which latter direction their efforts in recent years have been more directed.

Maui is easily the banner island in forest planting. The Pioneer Mill Co. at Lahaina, the Wailuku Sugar Co., and the Maui Agricultural Company are all actively engaged in this work. The last named corporation maintains regularly two forest nurseries in which trees are raised for planting on adjacent lands; one at Paia, under the charge of Mr. David T. Fleming; the other at Opana, for planting the lands there and at Kailili. This last nursery is in charge of Mr. Waldemar Hannestad, who justly takes pleasure in introducing visitors to his many acres of close set, thriftily growing forest of commercially valuable Eucalypts.

In view of the increasing demands for wood and timber that are necessarily a part of the development of this Territory, forest planting on a commercial scale cannot fail to yield good financial returns to those who have suitable, fee simple land and who can afford to embark on a long term investment. Forest planting in Hawaii is a form of investment admirably adapted for the long lived corporations. The market is sure, danger from fire and other risks has hardly to be considered, while the rapid growth of most of the trees used not only offsets the costs of establishing and caring for the forest but returns to the owner in much shorter time than he could count on in forest operations in most other countries, an extremely good profit on his investment. It would be to their own interest, as well as to the general good of the community, if more of the large corporations would devote a larger share of their waste and unproductive areas to growing commercial forest.

PLANT INTRODUCTION WORK.

One of the underlying objects of all the forest work in Hawaii is to discover trees good for one or another purpose that will propagate themselves readily and spread without human aid. The native Hawaiian forest is, as has been pointed out earlier in this report, of the greatest value as a watershed cover, but from the commercial standpoint much better results can be got from introduced species than from Hawaiian trees. The local needs in wood are for posts, ties, timber and fuel. These are best supplied by introduced trees, but by no means has the last word been said as to what introduced trees are best for local conditions. Indeed this field of investigation has as yet hardly been touched. The need is for trees that will be of value and that can be depended on to spread themselves. We are wonderfully fortunate in having the Algaroba, and from all appearances certain of the Eucalypts are becoming established so that in time they will make self-sown forests. But there are many places where these trees do not do well—non-productive areas that ought to be in forest, for which other trees must be found.

The only effective way of securing such desirable introductions is through systematic experimenting—the introduction and trial under varying local conditions of promising species. This is work that properly belongs to the Government. In trying out new plants there must necessarily be many failures. Private corporations, and still less individuals, as a rule do not care to plant trees unless there is at least a reasonable certainty that they will do well. But such investigation is essentially work that ought to be done, particularly in a country like Hawaii. Unless, however plant introduction is carried on carefully and in a highly systematic way much of it goes for nothing. It is work, too, that must be managed by technically trained men, for there is always the possibility that some plants may be introduced which it is not wise to permit to grow here. Therefore the experimental introduction of exotic trees and shrubs is one of the important investigations that lies before the Division of Forestry.

During the past two years progress has been made in this direction by the better equipment of the Experimental Garden in Makiki Valley and by improvements in the seed testing houses at the Government Nursery. These changes will facilitate later work.

The Territory has been fortunate in receiving at the hands of Mr. Gerrit P. Wilder, a former member of the Board of Commissioners of Agriculture and Forestry, seeds of a great variety of trees and shrubs, which he has secured during an extended tour around the world. These plants are now being propagated at the Nursery and the Makiki Station. Other consignments of exotic seed are constantly being received in a small way from various sources. The importance of this work is such that it justifies the making of ample provision for carrying it on. It is to be hoped that it can be expanded during the coming period.

Federal Experimental Planting.

Mention may properly be made here of the continuation of the experimental planting of temperate zone trees on the upper slopes of Mauna Kea and Haleakala, begun in 1908 under the auspices and at the expense of the Forest Service of the U. S. Department of Agriculture. Three consignments of seedling trees—pines, spruces and firs—have been obtained from forest nurseries on the American mainland and planted out in the fenced experimental plots on these mountains. While there have been severe losses, as was to be expected, the latest examination made showed that a fair percentage of the little trees were alive and apparently established.

During the spring and summer of 1910 seed of some forty odd kinds of temperate zone trees, both conifers and broadleaf species, was sown in seed spots in the experimental plots. It is too soon

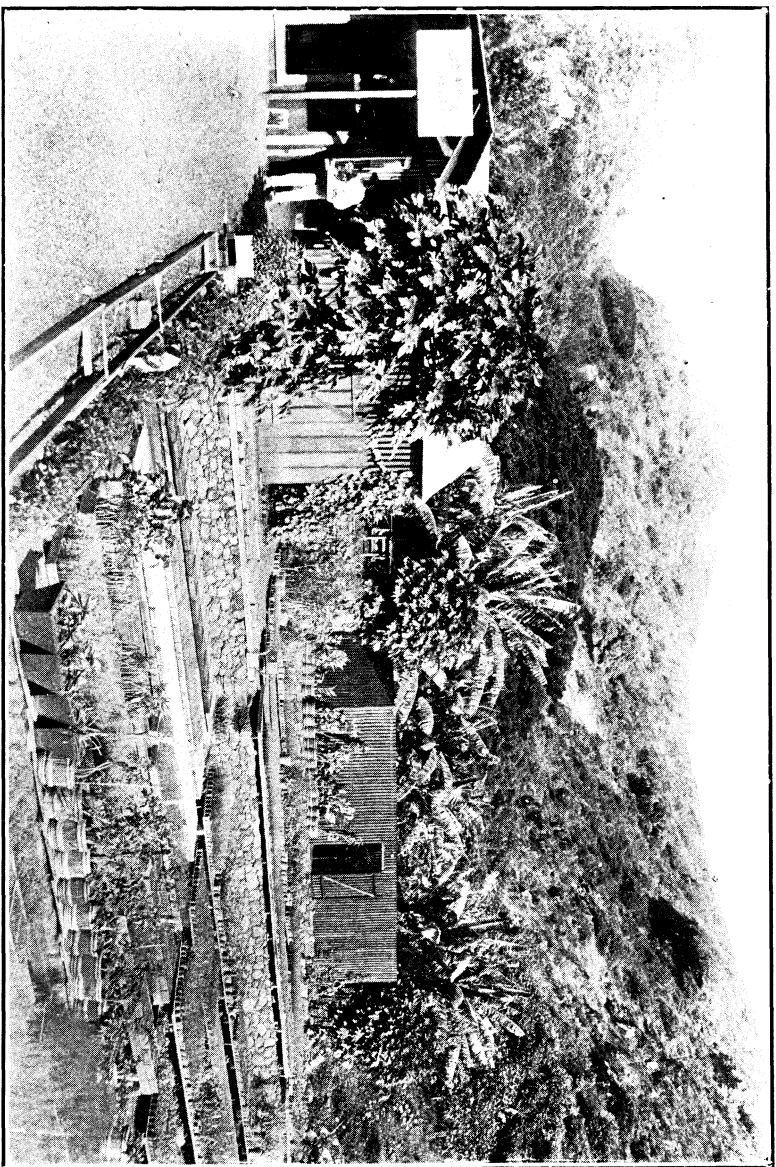


Plate 7. Experimental Garden, Makiki Valley.

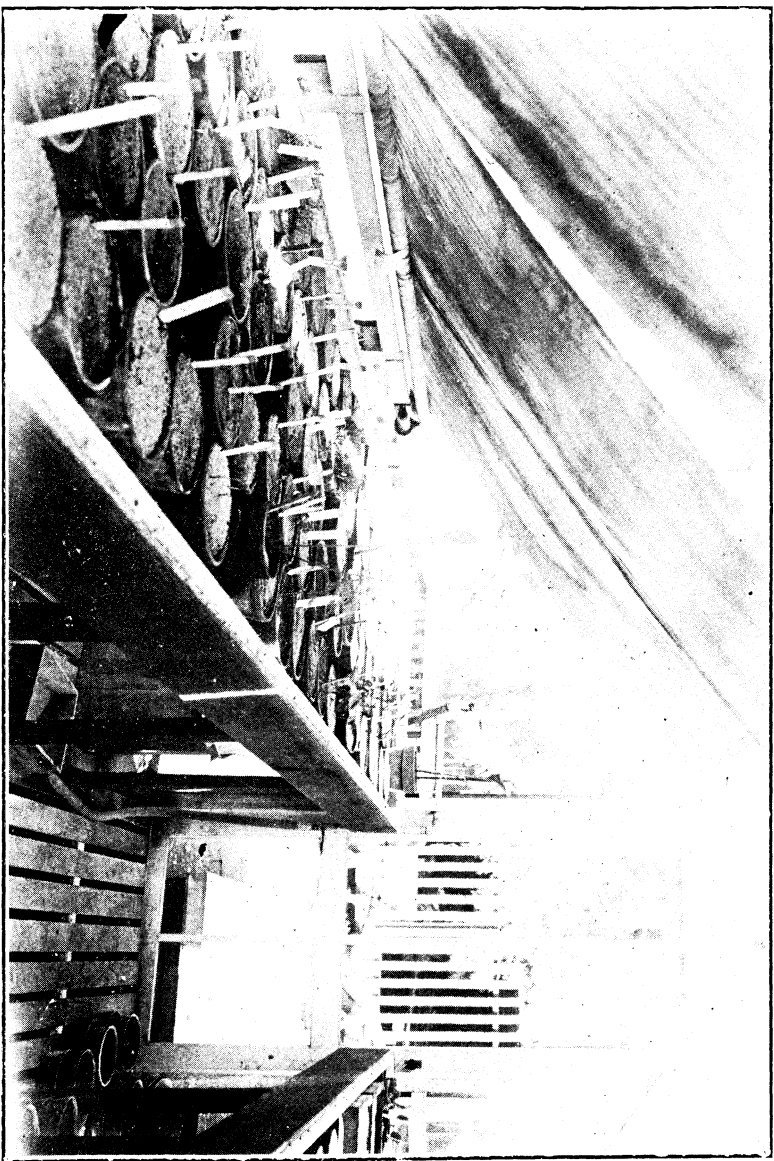


Plate 8. Interior of Propagating House, Government Nursery.
Here are started the seed of trees and shrubs new to the Islands.

yet to have data in regard to this experiment. During the spring of 1911 a considerable number of additional tests will be made and also there will be planted in some of the plots, seedling trees of a number of species of Eucalypts.

The amount allotted by the Forest Service for this project was \$2,000.00 for the fiscal year ending June 30, 1909. This was mostly spent in fencing in a number of five-acre plots on each of the two mountains.

Last year \$1,350.00 was allotted. This was used in the purchase and transportation of nursery stock, for labor, and for the enclosure of an additional plot on Mauna Kea.

This year the amount is \$1,000.00, which will be used mostly for labor in planting out seedlings and seed.

EUCALYPTUS STUDY.

Also in coöperation with the Forest Service there was undertaken, beginning late in 1909, a thorough investigation of the planted groves of Eucalypts in Hawaii, with the object of compiling and making available for the ready use of those interested all the information obtainable about the growth and yield under local conditions of trees of this valuable genus. Under an agreement whereby the Territory was to pay part of the cost of the investigation and to publish the results, Mr. Louis Margolin, Forest Examiner of the Forest Service, was temporarily detailed to Hawaii from November 1909 to May 1910, inclusive. During this time he visited all the Eucalyptus groves of importance in the Territory, made measurements and collected all the available data in regard thereto. The material so gathered he worked up in a report that is shortly to be published as Bulletin No. 1 of the Division of Forestry.

The appearance of this bulletin during the summer of 1910, as was expected, was prevented by shortage of funds. When it does come out, it should be of very considerable interest and real value to all tree planters in Hawaii, because it contains just the information needed by persons desiring to establish forest plantations. Eucalypts are among the most important of our introduced trees; this report brings together in usable form all the information now available about them under local conditions.

BOTANICAL INVESTIGATIONS.

A line of work of much interest during the past two years is the botanical survey of the forests of the Territory now being carried on by the Botanical Assistant of this Division, Mr. Joseph F. Rock. As Mr. Rock clearly shows in the introductory paragraphs of his own report, a study of this character is essential to a correct understanding of our forests. Without exact knowl-

edge concerning the habits of the trees and other plants found therein, plans for the proper care of the forest can not be as wisely made as when these data are available. The investigations being carried on by Mr. Rock deal in many cases with questions of pure science, but they all have their practical bearing in one way or another.

In his report along with an outline of the work done on his collecting trips, Mr. Rock records many interesting facts about the vegetation of certain little explored localities. It contains in this way much of interest from a geographical as well as from a botanical standpoint.

The importance of the results already got in this investigation justify better provision being made for it in the future. Not only are additional herbarium cases needed for taking care of the material collected, so that it will be protected from insects and housed in a manner where it will be readily available, but provision should also be made for the publication of results. This, as Mr. Rock points out, is an essential part of this sort of study.

Although somewhat out of place here, it might be said in this connection that the Board of Agriculture and Forestry has for some time had the manuscript of two bulletins ready for printing, the publication of which has been prevented by lack of funds. One is a popular treatise on "The Vegetable Garden in Hawaii," by Professor F. G. Krauss, which contains just such information about gardening methods as people are constantly asking for. The other is a compilation of the laws concerning, and the rules and regulations made by the Board of Agriculture and Forestry. Both are useful books, that ought to be published.

MISCELLANEOUS FOREST WORK.

The activities of the Division of Forestry are not confined strictly to the work described under the heads Forest Reserves and Forest Extension. Other branches of forest work are pursued as fast and as far as time and resources permit.

RUBBER INVESTIGATION.

As entitled, chronologically at any rate, to first mention, is the successful outcome of the investigation on methods of tapping rubber trees, carried on jointly by this Division and the Hawaii Agricultural Experiment Station during the spring of 1909. It will be remembered that out of its allotment for the fiscal period ending June 30, 1909, the Division of Forestry contributed \$1200.00 toward this study—the Experiment Station providing the men to do the necessary work in field and laboratory. This investigation proved that with systematic methods of tapping the Ceara rubber tree in Hawaii will yield profitable returns, a fact

that up to that time was in doubt. The full results of this investigation were published early in 1910, as Bulletin No. 19 of the Hawaii Agricultural Experiment Station.

EXHIBITS AND EDUCATIONAL WORK.

Following the policy that with a subject of such general interest to the people of the Territory as is Forestry, a legitimate amount of publicity is not only permissible but wise, the Division of Forestry prepared exhibits illustrating its work for the annual shows of the Hawaiian Poultry Association in 1909 and 1910, and for the Hawaii Building at the Alaska-Yukon-Pacific Exposition at Seattle, Washington, during the summer of 1909. In Mr. Rock's report will be found a description of this latter exhibit. For it the Board of Agriculture and Forestry was awarded a special diploma and a gold medal. The exhibit, being the property of the Territory, was returned to Honolulu, where it is now held with other like material until such time as it may again be needed. If there were space for it, this exhibit could well be set up in the Board's office, but the cramped quarters at the Government Nursery utterly preclude such a possibility.

Other educational work in forestry and in the closely related but still broader field of Conservation, has been carried on during the past two years by addresses and talks made by the Superintendent of Forestry before various assemblies, and by articles dealing with forestry prepared for various local publications.

In particular two Conservation meetings are to be recalled. The first was a joint session of the Senate and House of Representatives of the Territory of Hawaii, held in the Throne Room on March 1, 1909. It was called that the members of the Legislature might listen to addresses on the meaning and local necessity for Conservation. A complete report of this meeting was later published in pamphlet form, both in English and in Hawaiian, and generally distributed throughout the Territory.

The second meeting was somewhat similar in general character, being a public meeting held in the Throne Room on November 16, 1910, under the joint auspices of the Board of Agriculture and Forestry and the Hawaiian Sugar Planters' Association, to consider the practical application of the principles of Conservation to certain of our local economic problems. As in the case of the former meeting, addresses were made by a number of the men locally best qualified to present authoritative statements in regard to the several phases of the subject. A full report of this latter meeting appears in the Hawaiian Forester and Agriculturist for January, 1911. Because containing statements of general interest, not found elsewhere in just this form, the address of the Superintendent of Forestry is reprinted as a part of this report.

Among other addresses given by the Superintendent of Forestry were two lectures at the College of Hawaii in February, 1909; several talks at various times at the McKinley High School, the Normal School and Oahu College; speeches at the annual meetings of the Hawaiian Sugar Planters' Association and of the Hawaiian Rubber Growers' Association, and before several local clubs and literary societies.

Besides articles for the "Forester," several contributions have been made to the local newspapers, particularly for special editions. In connection with the exhibit at the Seattle Exposition a little circular was prepared showing why the practice of forestry is an economic necessity in Hawaii. This was distributed with other literature at the Hawaii Building.

As in former years all forest reserve reports and other official forestry papers have appeared in the "Forester" in due course, together with the proclamations and other By Authority notices in regard to the various projects.

NATIONAL IRRIGATION CONGRESS.

Mention has already been made of a special mission on which the Superintendent of Forestry was sent during the summer of 1909—officially to represent the Territory, with other delegates from Hawaii, at the Seventeenth National Irrigation Congress, held at Spokane, Washington, in August. As the result of the efforts of the Hawaii Delegation the following plank was included in the platform of resolutions adopted by that Congress:

"We urge the Congress of the United States to extend the Reclamation Act to the Territory of Hawaii."

A resolution of similar tenor was also secured at the First National Conservation Congress held in Seattle early in September, 1909, to which the Superintendent of Forestry was also a delegate. Addresses were delivered by him at both these meetings.

COOPERATION WITH OTHER LOCAL INSTITUTIONS.

The Division of Forestry stands essentially for the policy of team play in local institutions. Especially cordial relations are maintained with the Hawaii Agricultural Experiment Station and the College of Hawaii. The College, through its department of engineering, is now engaged with this Division in a coöperative investigation of the strength of, and proper seasoning methods for several island grown woods, both native and introduced species. Large beams of Ohia Lehua, supplied by the Pahoa Lumber Mill of Pahoa, Puna, Hawaii, have been broken by the powerful Riehle Timber Testing machine at the Coollege laboratory, and other tests made with this wood. Further, blocks

and small timbers of several species of *Eucalyptus*, cut in the Tantalus Forest under the direction of the Division of Forestry, are now being subjected to various seasoning tests. The results of these investigations will later be made public, probably in a bulletin to be published by the College.

Through an arrangement with the Oahu Railway and Land Company railroad ties have been cut from three species of *Eucalyptus* growing on Tantalus, *E. globulus*, *E. robusta* and *E. cornuta*, for trial under varying conditions in the track around this island. The ties are now being seasoned. When they are laid, careful record will be made and kept of their relative value.

LUMBERING OPERATIONS.

The exploitation of certain forests of the "commercial class" on the island of Hawaii has continued during the past two years; more particularly the logging of Ohia Lehua in the Puna District for railroad ties and other lumber.

In January, 1910, Mr. J. B. Castle's lumber company, now known as the Pahoa Lumber Mill, secured from the Territorial Government at public auction, the right to lumber the forest on a tract of unleased government forest land in Puna, adjoining the Kaohe Homesteads at Pahoa, and having an approximate area of 12,000 acres.

The Governor not deeming it expedient that this area should be set apart as a forest reserve prior to the lumbering, the Board of Agriculture and Forestry has no official connection with the management of the tract, but in the contract between the lumber company and the Commissioner of Public Lands there were included certain provisions suggested by the Superintendent of Forestry as the result of investigations made at the request of the Land Office.

Under the terms of the contract, which runs for ten years from January, 1910, the lumber company pays to the government a stumpage price of \$5.00 per acre for all forest cut over; subject, however, to the termination of the contract at the option of the government, after the expiration of five years.

The area covered by this contract is, as has been said, 12,000 acres; a block of heretofore practically unexplored forest. A portion at least of this tract is agricultural land, which will in due course be opened up for settlement. The section that is suitable only for forest ought to be set apart as a forest reserve.

In the matter of the utilization of Ohia Lehua, the original contract between the Pahoa Lumber Mill and the Santa Fe Railway has been revised. Ties are still shipped to California, but increasing attention is being paid to finding a market for Ohia for uses of higher grade. Especially is an effort being made to introduce Ohia as flooring—a use to which the firm, close texture

of the wood and its handsome color lend themselves admirably. The waste from the Ohia mills (slabs, etc.) is sold for firewood, not a little of it being shipped to Honolulu.

Another company, Cant & Bolte, Limited, is also operating in Puna, on privately owned forest lands. This company also sells its product both for ties and for lumber.

The latter firm is also conducting logging operations on privately owned lands in South Kona. These, it is expected, will later assume much more important proportions than they have at present.

FOREST FIRES.

The Territory has been extremely fortunate in the last two years in not having had any forest fires of sufficient importance to justify more than passing mention here.

At the same time it has been evident in several instances that it was a good thing to have a strict forest fire law on the statute books, for while there have been no active prosecutions, the moral effect of the law has more than once been felt.

That the absence of forest fires in this period may not create a sense of fancied security from danger, it must again be pointed out that at present there exists no fund from which expenses can be paid for fighting fires on unleased government lands. Under the present law the Government can compel its lessees and also private owners to take proper precautions as to the use of fire, on penalty of fines and damage suits, should fires originating on a given tract spread and do damage. But on its own unleased lands—and most of the lands in the forest reserves are now in this class—the Government is powerless to take effective steps to stop or to control fires that may start from one or another cause. The remedy lies in a provision whereby money for fighting forest fires shall be made available for use in case of necessity. This item could well be included with others, as in an appropriation for “fencing forest reserves and protecting them from forest fire.” Such an emergency forest fire fund should amount to at least \$5,000. It is devoutly to be hoped that the need for it may never again arise in Hawaii, but as in other forms of insurance, the wise course is to be fore-armed.

THE DISTRICT FORESTERS.

REPORTS OF DISTRICT FORESTERS.

Following the custom of former years, opportunity was given each of the District Foresters to submit notes of forest happenings in their respective districts or recommendations in regard to forest work. The following extracts are taken from the reports received:

A. S. Wilcox—Lihue, Kauai.

"Your communication asking for a brief report on forest happenings came duly to hand. In reply I would say that in the district of Halelea, in which I act as District Forester, the conditions remain somewhat similar to those mentioned in my former report.

"Private Forest Reserves: Practically half of the land of Kalihiwai has been a private forest reserve for many years. The growth is dense, and this has rendered fencing unnecessary. The area, roughly speaking, is about 4000 acres. The land is owned by myself, and it has always been my purpose to protect the forest as much as possible in order to maintain the water supply. This Kalihiwai land, in conjunction with the forest on the upper lands of Hanalei, makes quite a large forest reserve. The few cattle which formerly got into this reserve have all been removed.

"Forest Fires: There have been no extensive forest fires, and no damage done by cattle to signify. I may say that there was a very small fire several months ago on the lands of Waioli, but apart from the burning of the undergrowth and the scorching of a few trees no serious damage resulted.

"In general, I would say that with the absence of any destructive forest fire, the reduced number of cattle ranging in the forest reserve, and an abundant rainfall, these conditions have tended to keep the forest reserve in excellent shape."

W. R. Castle—Honolulu.

"As I have never made a written statement of my forestry work on the southeast slope of Pauoa, I will give you a word about that now.

"I have about thirty acres of mountainside on the southeast side of Pauoa Valley. When I acquired the land some years ago, it was covered with grass only, excepting a few Eucalyptus and some trees which came down over the crest of the ridge in one or two places. During the past five years I have planted about 2000 koa trees and perhaps 3000 Eucalyptus of various descriptions. Besides these main lines, I have planted a great variety of other trees and shrubs, so that the mountainside now begins to have quite a forest appearance. It is my intention to let the public use this ground for purposes of recreation, etc., with proper restrictions as to fires and so on.

"In Kona, where I have been largely interested, nothing has been done in the line of setting out new forest—except

by private individuals, so far as I know, and not a great deal of that. But in my own lands of Papa, etc., I am now setting out Eucalyptus, Rubber, and other trees, and intend within a short time to build fences and other guards to prevent the incursion of cattle on the upper lands, where there is today a heavy growth of Koa, Ohia and other Hawaiian forest growths. Of all of which I will give you fuller particulars later."

H. B. Penhallow—Wailuku, Maui.

"Other than the usual yearly tree-planting of the Wailuku Sugar Company, there is nothing of special note to report concerning forestry in this district.

"There is a rumor, however, that some Hawaiians are running cattle in the forest reserve back of Waikapu, but have not been able to look into this carefully. If there had been an available forest ranger, this matter could have easily been taken up, and if cattle are being run on the reserve it would have been stopped long ago. I believe that even if the necessary number of rangers could not be provided for by the funds available for your Board, a few would be of great benefit. There is no doubt that there are a great many abuses which are going on in the reserves, which a few rangers would prevent."

L. von Tempsky—Makawao, Maui.

"During the year 1909 I planted out some 19,314 trees, of various sorts and at various altitudes; also in localities where climatic conditions were unlike, viz., in the Hilo grass or windward district, and in the Kula or dry district.

"The highest altitude at which the trees are planted is a little over 6000 feet, and the lowest 2000 feet. The varieties planted are mainly Eucalypts, comprising botryoides, corynocalyx, crebra, gunnii, leucoxylon, rhilaris, polyanthema, rostrata, saligna and some *Cryptomeria Japonica*.

"In September, 1909, I planted in the Hilo grass land 3350 *Cryptomeria Japonica* at an elevation of 2800 feet, also 1200 *E. botryoides* and *E. rudis*, about half of each kind. The Eucalypts were planted in the formation of two sides of a square, the object being that later on they would form a breakwind for the *Cryptomeria Japonica*, which tree has a strong objection to the tradewind. The Eucalypts have done exceedingly well, and seem very well suited with the conditions that obtain there. The *Cryptomeria* has also thriven well and has grown very fast, almost equaling the growth of the Eucalypts. I may also mention that where the land was

furrowed out for planting, innumerable Kōa trees made their appearance; this seed has been lying dormant for the last twenty-five years to my certain knowledge, as I was all over that locality at that time, and the forest then was a thing of the past.

"The other plantings of that year took place in October, at about 6000 feet elevation on the Kula side of the ranch; unfortunately the weather conditions after the planting was finished were not at all favorable, and, although we did not lose a great number of trees, it set back their growth considerably. I also planted 300 Eucalypts at about 6300 feet elevation on the windward side, mauka of the forest line; these trees also suffered from the dry weather which was prevalent all over the ranch at that time. These two plantings of like species, at approximately the same elevation, and at the two extreme ends of the ranch where usually weather conditions are decidedly unlike, should form in the future an interesting subject for comparison.

"The area planted in lots amounted to forty-four acres, taking 16,444 trees, or about, say, 375 trees to the acre. The balance, 2870, being planted along fences, etc., etc.

"The trees planted on the mountain were principally intended for shelter purposes for stock.

"In December, 1910, I planted 11,300 trees. I had a great deal of trouble with the seed, which delayed the growth of the seedlings, causing the planting to be later than usual and running over some five or six thousand into 1911, which should have been planted in 1910; these will not be put into the ground till February or March.

"I planted seed of some twenty-five different species of Eucalypts (a list of which I append herewith); some of the seed was very slow of germination, and some did not sprout at all, so that I had only nineteen varieties that were fit to transplant into the identification lot, a list of which I also append.

"In the identification lot (five acres) I have planted 2000 trees arranged alphabetically from E to W. This lot has been thoroughly plowed and harrowed, and I intend at the proper time to plant potatoes and beans between the rows of trees to reduce, if possible, the cost of cultivation of these trees; a report of this work and the results thereof will be forwarded you later on. The elevation of this lot is 2300 feet, and it is situated immediately mauka of the ranch house lot.

"The balance of the year's planting was done on the mountain, the highest elevation being Lot No. 13, which is close

to 6800 feet, and is situated at the foot of Puu Oili on the western side.

"This lot, and all others planted on the mountain with one exception, are for stock sheltering purposes, and in a few years' time will be of great service to the ranch in protecting its stock from the raw, cold winds that blow there, and also for protecting them from the fierce rays of the sun.

"One lot I planted (ten acres) at and above a spring which supplies water to our mountain dairy. I have planted immediately around the spring 1000 *Grevillea robusta*, the balance, 1300, are *Eucalypts* of various sorts. I find from experience that the *Grevillea robusta* in a very short time will form a very deep mat from the leaves that it is constantly shedding, which should form a fine sponge for retaining the moisture, incidentally, I hope, increasing, or, rather, making more permanent, the flow of the spring.

"Outside of the foregoing, I may mention that I have had scattered on the plains at an elevation of from 800 to 1000 feet, 150 sacks of horse manure; this manure was fully impregnated with Keawe seeds, and I hope in a few years to have a fine young Keawe forest growing there, as the *Algaroba* grows well on the western slopes of Haleakala up to an elevation of 1200 feet. We have some trees growing as high as 2800 feet elevation. Of course, the growth at that elevation is not so rapid as it is at or near sea level, but still they seem to get along very well.

"It may be of interest to you to know that since January, 1900, I have planted about 140,000 trees, of which 138,380 are growing. The area planted in lots is 256 acres, taking 127,230 trees, the balance, 11,150, have been planted along fences for breakwinds, etc. These trees have cost up to date four and a half cents each, which includes everything, such as purchase of seeds, nursery work, plowing, holeing, hoeing and fencing."

List of twenty-five varieties of *Eucalypts* planted at the Haleakala Ranch:

<i>Eucalyptus</i>	<i>bicolor</i>	<i>Eucalyptus</i>	<i>obtusifolia</i>
"	<i>botryoides</i>	"	<i>paniculata</i>
"	<i>calophylla</i>	"	<i>pillularis</i>
"	<i>corymbosa</i>	"	<i>polyanthema</i>
"	<i>corynocalyx</i>	"	<i>regnans</i>
"	<i>diversicolor</i>	"	<i>rostrata</i>
"	<i>ficifolia</i>	"	<i>rudis</i>
"	<i>goniocalyx</i>	"	<i>saligna</i>
"	<i>leucosydon</i>	"	<i>siderophloia</i>
"	<i>longifolia</i>	"	<i>siberiana</i>
"	<i>melliodora</i>	"	<i>tereticornis</i>
"	<i>microtheca</i>	"	<i>viminialis</i>
"	<i>obliqua</i>		

Geo. C. Watt—Kohala, Hawaii.

"The Kohala Sugar Company is planting the exposed sites of gulches and in waste places where cane cannot be grown at a profit. The object of planting is as windbreaks and for fuel.

"I am not able to give yields from planted acres, but from trimming and thinning out of trees we have obtained sufficient fire-wood for all of our labor for the last three years. The shelter they afford to cane fields in a windy district like Kohala more than compensates for the outlay."

John Watt—Olaa, Hawaii.

"The only matter of note which has taken place here during the years 1909 and 1910 is the operations being carried out by the Pahoa Lumber Mill at Pahoa. In the past two years they have lumbered something over 1000 acres. This has been partly upon the Catholic Mission lands at Pahoa and Kaohe homesteads and Government land mauka of the Kaohe homesteads.

"A considerable area of the land cleared by this company has been planted to cane, and during the coming planting season the Olaa Sugar Company will plant some two or three hundred acres of this cleared area. So far as I know most of the land cleared of trees is arable, and fairly good agricultural land. As you are quite familiar with the operations being carried on by this company, it is needless for me to go into details.

"There is no other change in the condition of the forests in this district worth mentioning, except that I might again call your attention to the condition of the Government Reserve along the Volcano Road from the 13 miles up. This reservation has never been fenced, and many of the trees are dead on account of the residents along the line of the road pasturing horses and cattle. I have on a good many occasions tried to get these people to keep their animals off, but so far without success. The forest otherwise seems to be in a healthy condition, and no forest fires have taken place during the past twelve months."

R. von S. Domkowicz—South Kona, Hawaii.

"In accordance with your request, I hereby submit my report as Forester of the South Kona District, covering the area from the Kau boundary line to Kaohe.

"There has been very little change in the condition of the forest in this district since my previous report. The forest where it is kept free from cattle is in good condition, and there have been no noticeable insect pests.

"Planting of forest trees has not been done here to a great extent, except the few trees which I have set out, grown from seeds sent me through the courtesy of your department. And all these are doing well, especially *Cryptomeria Japonica*, Cypress, Ironwood, and *Grevillea robusta*; the latter seedling within four years of setting out.

"As there are no forest reserves in Kona, my district, I would respectfully urge that the Kipahoe and other available lands be set aside for forest without delay, and, if possible, fenced.

"Owing to the operation of the Lumber Company here, which is cutting down trees indiscriminately on several private lands, there will be no forest in a few years to give protection to vegetation and give rain."

John Maguire—North Kona, Hawaii.

"The constant dry spells which Kona seems to be having almost discourages one in the effort at tree-planting, and yet it is wonderful how some of the trees which evidently seem dry during the drought quickly come to life again after one or two good showers. The *Grevillea* is quickly spreading all over the pastures, just from a row of trees along the road. The wind and birds are scattering the seeds all over. A thousand and one or two hundred of trees have been planted on Akahipuu, one of the spurs of Hualalai, 300 and more of *Grevilleas*, over 200 *Eucalyptus*, 66 *Pepper*, 51 *Monterey Cypress*, 28 *Manele*, 34 *Kukui*, 125 different *Pine*, 16 *Jackaranda*, about 100 *Peach*, about 30 *Cherimoyers*, and a few figs and alligator pears, which will probably never bear, as the elevation is over 2000 feet.

"The twelve Japanese Cedars are doing very well; then there are a variety of other trees. The *Eucalyptus* are mostly the *botryoides* and *rudis*, a few *robusta* and lemon scented. The enclosure will probably hold another thousand or two trees. The object of covering the hill with trees is to gather whatever moisture may collect around it and also to beautify Huehue. We have tried to plant trees that will be of commercial value later on. The *Grevillea*, we hear, makes very fine furniture wood. It is hard and makes good fence posts and shoots out again when cut down.

"The forest reservation of Honuauia is doing very well, the undergrowth having grown a great deal. It is a pity though that it is so small (only 600 acres), when there are thousands of acres of Government land around.

"The thimble berry is spreading very rapidly, and in a few

years' time will destroy more pasture land than the lantana ever did. There was a portion on Honouaula where the cattle were actually lost and could not be seen in the thimble berry growth, and there were places that the men and horses could not get through. One has to see to realize what a pest it is."

SUMMARY OF RECOMMENDATIONS.

In the foregoing pages there have been traced briefly the main activities of the Division of Forestry during the past two years. It has been shown that with no increase in appropriations over former periods—except for two special projects of forest planting—much useful work has been done and many good results accomplished. The lack of funds has, however, hampered progress in many ways. Lines of work that ought actively to be pushed have had to wait, while much of the work in hand, like that of the sub-nurseries, has been hindered by the inability to supply needed equipment. There is so much forest work waiting to be done in Hawaii which would yield definite and practical returns that it is doubly unfortunate that adequate provision for it is not made.

Besides covering the official work of the Territorial Government in forestry this report also shows, by enumerating various pieces of forest work now in progress under private auspices, that in Hawaii forestry is not regarded merely as a function of the Government. Rather do these things prove that the general and well informed interest that now unquestionably exists throughout the Territory rests on the sure foundation of well grounded belief in the principles of Forestry and of Conservation.

For the very reason that this is so, better provision ought to be made for continuing and extending the Government's share of forest work. Appropriations for forestry are legitimately to be regarded as investments. The existing forests of Hawaii are today of great value to the Territory. They could be made of much more value if they were better taken care of. Similar considerations apply to other branches of forest work. With more local nurseries many more persons could be supplied cheaply with trees. More forest plantations would be started, as well as more trees planted for ornamental and esthetic purposes. With increased appropriations the Government could itself go ahead with forest planting on some such scale as it really ought. All of which would in the end make for the permanent betterment of the Territory.

So, too, with the introduction of new trees and shrubs. With better provision for this work vastly more could be accomplished; especially now that the machinery of plant-houses and experimental gardens has, in part at least, been provided.

That the facts found out in these and the other investigations carried on by the Division of Forestry may be widely disseminated among all the people of the Territory provision should be made for the publication of bulletins and circulars, the emphasis being placed always on those which shall make available the required information in a form in which it can be used by the every day citizen.

Two things are to be borne in mind in regard to forestry, be it in Hawaii or be it anywhere else in the United States. First, that forestry is a business proposition, in that forests are grown to meet definite, practical economic needs. And second, that forestry is a matter which concerns the individual and the corporation as well as all the people collectively. We are too prone to think of the Government as something apart from the People. The reason why forestry is practiced in this Territory is because it serves the interests of the people of Hawaii better to have certain portions of the islands under a forest cover than to use those lands in any other way. Similarly the corporations that are active in protecting the native forest on their own fee simple lands, or that are establishing new forests of introduced trees, are doing it, and should do it, because it is to their interest so to do. Forestry is essentially a matter of business. Greater care in the administration of our forests is urged because it is better business to take good, rather than poor, care of them. The more generally these truths are realized the better it will be for all concerned.

Forestry in Hawaii is then, a matter which concerns both private interests and the Government. Each manager of a corporation owning or controlling land should look to it that his forests are well cared for and that waste or other land that cannot be utilized more intensively, is planted with trees. And the people as a whole, through their representatives in the Legislature, should make adequate provision for the proper care and development of the forest areas belonging to them, but managed for them by the officers of their government—the forests on government land.

Specifically as regards the government forests of Hawaii provision should be made by adequate appropriations for five main branches of forest work:

(1) For the proper maintenance and protection of the existing native forests—through the fencing of forest reserve boundaries, the care of the forests and their protection from trespass by forest rangers, and a special fund, to be used only in case of need, for fighting forest fire;

(2) For the planting of open places in forest reserves and of other government lands where the growing of a forest is the best use to which the land can be put;

(3) For the extension and better equipment of the system of sub-nurseries and local distributing points for the giving away of trees;

(4) For the introduction and experimental planting of economically desirable trees and shrubs new to the Territory;

(5) For the general administrative and routine expenses of the Division of Forestry in carrying out these several branches of work and in its more strictly technical investigations, such as the work being done in connection with the Herbarium; it being understood that the allotment for this last section should be sufficient to include provision for the publication of results.

Forestry has a very definite duty to perform in Hawaii. Its place has come to be well recognized. It is for the people of the Territory now to demand that provision be made for forest work in a measure commensurate with its importance.

Very respectfully,

RALPH S. HOSMER,
Superintendent of Forestry.

Report of the Forest Nurseryman.

Honolulu, Hawaii, December 31, 1910.

R. S. Hosmer, Esq.,
Superintendent of Forestry,
Honolulu, Hawaii.

Dear Sir:—I herewith submit a report of the work done at the Government Nursery, Experiment Station, Makiki, Tantalus Forest and Nuuanu Station for the years 1909 and 1910.

NURSERY.

COLLECTION AND EXCHANGE OF SEEDS.

The collection of seed has been continued and the demand is increasing. The local demand is greater than it has ever been, owing to a large number of corporations and others starting to do tree planting. Our exchange list includes institutions in almost every country on the globe, from a number of which we are continually receiving requests for seed of our exotic and indigenous plants.

A great deal of the Eucalyptus seed wanted for local use is collected on Tantalus; in fact, the great bulk of the forest tree seed used in the Territory is collected locally. The price charged for seed collected by us is less than half of the cost of similar seed if compared with the catalogue prices in other countries. Our prices are based on the cost of collecting.

In the introduction of seed and plants new to the Territory great credit is due Mr. Gerrit P. Wilder, who has been untiring in his efforts to introduce new plants and seed. Mr. Wilder has collected and forwarded plants and seed from the following countries: Manila, P. I.; Singapore, Straits Settlement; Penang, Strait of Malacca; Hongkong; Colombo, Ceylon; Calcutta, B. I.; Naples and Florence, Italy; Vienna, Austria; Carlsbad, Bohemia; Brussels, Belgium; Godsberg, Germany; London, England; Paris, France; also from a number of places in the West Indies.

Mr. Wilder was at Antigua when this report was being prepared. Porto Rico, Jamaica, Havana, Cuba, Mexico and California are also included in the list of places he intends visiting.

The seed and plants received from Mr. Wilder are being started in our propagating houses, and every attention and care used in

fostering the growth of the many different species. A record of all the seed and plants collected and forwarded to us is kept on file and can be referred to at any time, the dates when received, also donors and species, being carefully kept.

A list of the seed distributed and introduced by exchange and otherwise is herewith enumerated. The list does not include the full amount of seed collected, as there is always from one-fourth to one-half of unavoidable waste owing to the loss of vitality; also by insects and other causes. We endeavor to give the freshest and best seed that can possibly be got; consequently, if there is any doubt regarding its vitality, etc., it is discarded and new seed used.

Owing to a weevil that has made its appearance within the last two or three years and is doing much damage to the seed of the different *Cassias*—which include the Golden Shower, Pink Shower, Pink and White Shower, as well as other trees—it looked as if it would be impossible to get any good seed from the trees affected. We found, however, that by picking the seed just before it got ripe and handing it to Mr. E. M. Ehrhorn, Superintendent of Entomology, who has invented a form of fumigation which kills the insect without harming the seed, we can manage to continue raising those trees and distributing the seed.

The following is the amount of seed distributed, by weight:

	Forest Tree	Shade and Ornamental	
	Seed.	Tree Seed.	Palm Seed.
1909	29 lbs.	75 lbs.	62½ lbs.
1910	48 lbs.	118½ lbs.	105 lbs.

The great bulk of this seed is used for exchange purposes, also supplying the Nursery, Homesteaders, District Foresters, etc., all of whom received seed gratis.

Seed Received Through Exchange.

1909.	Pkts.	
Feb. 19.	1	Mr. A. Robertson, Proschowsky, St. Helene, Nice, France.
Mar. 5.	17	Royal Botanic Garden, Ceylon, at request of Mrs. Dora Isenberg, Kauai.
Mar. 22.	1	R. v. S. Domkiewicz, Kona, Hawaii.
Mar. 22.	1	James Lindsay, Haiku, Maui.
Mar. 23.	28	J. F. Rock (from Dec., 1908, to March 23, 1909).
Sept. 3.	3	Royal Botanic Gardens, Sibpur, near Calcutta.

1910.	Pkts.	
Jan. 10.	2	J. G. Jack, Arnold Arboretum, Jamaica Plain, Massachusetts.
Jan. 10.	3	The Yokohama Nursery Co., Yokohama, Japan.
Jan. 10.	14	Al Giardinaggio, Napoli, Al Borsa.
Jan. 10.	1	No name.
Jan. 18.	2	H. Louis, Red Bluff, California.
Feb. 7.	5	Imperial Biological Agr. Institution, German E. Africa.
Feb. 24.	1	Dep. Van Landbouw te Buitenzorg, Java.
Apr. 1.	16	Gerrit P. Wilder from Manila, P. I., and Ceylon.
Apr. 12.	2	Gerrit P. Wilder, Singapore, Straits Settlement.
Apr. 14.	2	Chas. H. Muir, Major 23rd Infantry, P. I.
Apr. 15.	54	Gerrit P. Wilder, Rangoon, Burmah.
Apr. 20.	2	Agricultural and Horticultural Society of India.
Apr. 20.	8	Y. Wada, Kumamoto Forest Station, Japan.
Apr. 29.	33	Gerrit P. Wilder, Singapore, Straits Settlement.
May 4.	1	R. F. G. Timully, Africa.
May 5.	1	Royal Botanic Gardens, Sibpur, near Calcutta.
May 5.	8	Gerrit P. Wilder, Colombo, Ceylon.
May 5.	1	Botanic Gardens, Pamplemousses, Mauritius.
May 10.	13	Experiment Sta. H. S. P. A.: seed from Africa.
May 11.	16	Gerrit P. Wilder, Naples, Italy.
May 11.	7	T. Inemura, Gov. Bot. Gardens, Formosa, Japan.
May 16.	132	Royal Botanic Gardens, Sibpur, near Calcutta.
May 18.	1	Dep. van Landbouw te Buitenzorg, Java.
May 19.	2	Gerrit P. Wilder, Florence, Italy.
June 1.	4	Gerrit P. Wilder, Florence, Italy.
June 7.	6	J. G. Jack, Arnold Arboretum, Jamaica Plain, Massachusetts.
June 16.	4	Gerrit P. Wilder, Vienna, Austria.
June 21.	12	Tokyo Plant-Seed & Implnt. Co., Tokyo, Japan.
June 27.	1	Royal Botanic Gardens, Sibpur, near Calcutta.
June 27.	8	Dr. F. Franceschi, Santa Barbara, California.
June 27.	4	Hawaiian Sugar Planters' Association, Honolulu.
June 27.	10	Rev. H. Isenberg, Kauai; seed from New York and Germany.
July 21.	3	Harry H. Shaw, Honolulu.
Aug. 19.	10	T. Inamura, Botanic Gardens, Koshun, Formosa.
Aug. 29.	12	Gerrit P. Wilder, Carlsbad, Bohemia.
Sept. 7.	6	E. M. Ehrhorn, from Bolivia.
Sept. 10.	12	Gerrit P. Wilder, Carlsbad, Bohemia.
Sept. 20.	1	Royal Botanic Gardens, Sibpur, near Calcutta.
Sept. 20.	7	Gerrit P. Wilder, Brussels, Belgium.
Sept. 28.	5	Gerrit P. Wilder, Brussels, Belgium.
Oct. 4.	1	Gerrit P. Wilder, Brussels, Belgium.

1910. Pkts.

Oct. 18.	4	Dr. Watase, Tokyo, Japan.
Oct. 21.	1	Dept. Agriculture, New Zealand.
Oct. 25.	3	Capt. J. Kidwell, from Botanic Gardens, Uganda, Africa.
Oct. 25.	3	Gerrit P. Wilder, Godsberg, Germany.
Nov. 2.	6	J. G. Jack, Arnold Arboretum, Jamaica Plain, Massachusetts.
Nov. 9.	9	Gerrit P. Wilder, London, England.
Nov. 14.	3	Gerrit P. Wilder, Kew Gardens, London, Eng.
Nov. 16.	4	North Island, New Zealand.
Nov. 23.	3	Botanic Gardens, Koshun, Formosa.
Nov. 23.	2	Gerrit P. Wilder, Paris, France.
Dec. 5.	7	Gerrit P. Wilder, London, England.
Dec. 15.	8	Botanic Gardens, Koshun, Formosa.
Dec. 21.	—	Gerrit P. Wilder, West Indies.
Dec. 27.	134	Gerrit P. Wilder, Antigua, W. I.

DISTRIBUTION OF PLANTS FROM GOVERNMENT NURSERY AND
MAKIKI STATION.

Sold and given gratis, including Arbor Day, from January 1
to December 31., 1909.

	In seed boxes.	In boxes transplanted.	Pot-grown.	Total.
Sold	30,000	3,400	3,576	36,976
Gratis	9,000	2,000	1,000	12,000
Arbor Day ..	.....	25,000	16,777	41,777
Total	39,000	30,400	21,353	90,753

Sold and given gratis, including Arbor Day, from January 1
to December 31, 1910.

	In seed boxes.	In boxes transplanted.	Pot-grown.	Total.
Sold	95,000	10,347	15,634	120,981
Gratis	25,400	33,505	22,430	81,335
Arbor Day ..	.....	.....	8,071	8,071
Total	120,400	43,852	46,135	210,387

It will be seen from the above tables that there is a large increase in the number of plants sent out in the seed boxes. This system was first started about three years ago, when a ship-

ment of Ironwood was sent as a trial to Mr. Jas. Gibb, then manager of Paauhau Plantation, Hawaii. It seemed to work well, and more shipments were made. Since then shipments of seedlings have been sent to different people in Hamakua and Kohala, also several places on Oahu and Kauai, with good results. We have found, however, that should the plants receive rough treatment at the hands of the steamship people or others, there is liable to be considerable loss.

A box containing from 700 to 1000 Eucalyptus or Ironwood plants costs \$1.00 at the Nursery, the size of the box being 3 inches deep and 12x16 inches. Plants in same size of box transplanted, 50 plants to each box, cost from 75 cents to \$1.00, according to species, while pot-grown plants are from 1½ cents to 2½ cents each. It will be seen that in shipping plants in the seed boxes the freight bill is reduced considerably, the freight being the same for a box containing from 700 to 1000 seedlings as it is for a box holding 50 transplants.

Before the seedlings are sent out, they are past the damping-off stage, and there ought to be very little loss if handled rightly. Any careful man can do the transplanting. This system is to be recommended to those ordering plants from the Nursery in large quantities for the reason that transplanting involves often more labor than we have at our disposal.

We require advice in advance should large numbers be wanted; from six weeks to two months for seedlings, and about three months for transplants ready to set out.

Free List.

The following is a list of those who have been given plants gratis during the past two years. Whether this liberal free list can be kept up in the future will depend on the labor at our disposal and the demand of people who may wish to pay for plants:

Leper Settlement, Molokai.

All the schools of the Territory, public and otherwise.

The different Road Boards on Oahu.

Public grounds of all descriptions, including court yards, cemeteries, and church yards.

Improvement Clubs, for street planting.

Homesteaders who do not have the means to buy trees.

The U. S. Military and Naval Stations, forts, barracks and yards.

The list of plants given gratis includes the planting at the Pupukea Forest Reserve, above the Pupukea Homesteads—over 30,000 having been used, principally *Eucalyptus robusta*, with about 3,000 divided as follows: Japan Cedar (*Cryptomeria*

japonica), Monterey cypress (*Cupressus macrocarpa*), and Highland Ironwood (*Casuarina quadrivalvis*).

Large quantities of trees have been sent to the different military headquarters (Fort Shafter, Fort Ruger, Schofield Barracks); also the Naval Station. And a request has been received from Lieut. Roy Smith, who is in charge of laying out the grounds at Pearl Harbor, for a large number of trees, as well as instructions about planting. A great many different kinds are still wanted for the places mentioned, and we are trying to get as many as possible ready.

NURSERY GROUNDS.

During the month of October, 1909, part of the fence around the grounds was removed, leaving the strip around the offices, nursery and cottage enclosed. Since the removal of the fence I am glad to state that very little damage has been done to the trees, and quite a number of people have been using the park for the purpose of studying the trees, as well as for recreation.

We are again indebted to Sheriff Henry for his kindness in supplying us with the use of two prisoners, without which it would be impossible for us, with the present help of one man, to keep the grounds in good condition. Mr. Henry has also on two occasions sent a gang of men to the Makiki Station to assist in trenching and levelling, for which we are very much obliged to him.

REALIZATIONS.

During the years 1909 and 1910 there has been collected and deposited with the Treasurer of the Territory, as a Government realization, the sum of \$989.20. The amount is itemized as follows:

1909—Sale of plants	\$352.35	
Sale of seed	14.40	
Sale of wood from Tantalus.....	82.00	
Freight on plants	2.50	\$451.25
<hr/>		
1910—Sale of plants	499.25	
Sale of seed	22.20	
Sale of wood from Tantalus.....	2.50	
Sale of boxes	1.00	
Freight on plants .....	.50	
From Division of Animal Industry for hauling garbage	12.50	537.95
<hr/>		
Total		\$989.20

ADVICE AND ASSISTANCE.

Under the above head the writer is frequently called to all parts of the city, and sometimes to the outside districts. Numerous calls are also made at the office. The demand for advice and assistance has increased a good deal during the past two years. This is due principally to the presence of the military organizations and also to the large number of people who have bought land in the suburbs and are building homes. Many of the people who are making homes have recently arrived from the mainland, and, of course, know little or nothing about what to plant or how to go about it. By such people as these a large number of requests for advice and assistance are being made.

The officers of the different military organizations are also anxious to beautify their respective posts, and numerous requests for plants, and also for advice and assistance are continually being made. The following gives a number of the most important requests that have been made from the outside districts.

Kukaiiau Plantation Company.

Government Lease #623, Kaohe 11-B.
 Government Lease #625, Hoca-Kaao Mauka.
 Government Lease #626, Manowaialee.
 Government Lease #627, Niupea Kealakaha.

A planting plan for the above-mentioned tracts of Government land lately leased to the Kukaiiau Plantation Company and situated in the District of Hamakua, Hawaii, with provisions for tree planting, April 20, 1909.

Lower Pouhala in Waikele, Oahu. (Kunia)

At the request of Mr. A. W. Van Valkenberg an examination was made of a tract of land lately leased by him from the Honouliuli Ranch Company. The tract adjoins the land controlled by the Hawaiian Fibre Company at Lower Pouhala, Waikele. Advice was wanted regarding the best kinds of trees to plant; also how to plant them. June 15, 1909.

Pioneer Mill Company.

Report with recommendations on the planting of trees on certain lands belonging to the Pioneer Mill Company, Lahaina, Maui. July 15, 1909.

Grove Farm.

At the request of Hon. Geo. N. Wilcox, Grove Farm, Lihue, Kauai, a visit was made for the purpose of giving advice on the propagating of trees, etc. October 31, 1909.

Pupukea, Koolauloa, Oahu.

Report with recommendations on two tracts of land set aside as water reserves.

Waialua Agricultural Company.

At the request of Mr. W. W. Goodale, manager Waialua Agricultural Company, an examination was made of two tracts of land intended to be planted in trees. One tract contained 34 acres and the other 25 acres. Advice was wanted regarding the best trees to plant, etc.

CONGRESSIONAL VEGETABLE SEED.

During the month of January, 1909, a consignment of vegetable seed, consisting of 10,000 packages, and also about 300 packages of flower seed, was received from the Honorable J. K. Kalanianaʻole. Another similar consignment was received during the month of January, 1910, and the last consignment of 10,000 packages of vegetable seed and 300 packages of flower seed was received, for the year 1911, on December 1, 1910.

The demand for this seed is getting greater each year, and the seed is very much appreciated by homesteaders, and, in fact, every person who may have a small piece of land. Requests come from all over the Islands for packages of the congressional vegetable seed with good reports regarding the previous lots. Many Hawaiians who never tried to raise vegetables before are now, owing to this free distribution, planting and raising vegetables for their own use, and from these people a great many requests for seed are coming in.

All the schools of the Territory receive annually a number of packages for the school garden and for instruction. All applications for seed sent by mail receive prompt attention. Persons calling at this office can get what they want and take it with them.

EXPERIMENT GARDEN, MAKIKI.

During the past two years several additions have been made to the buildings. A lath house, 18x36x10 feet high, was built

and an addition to the potting shed and store room; also a shed for hold soil, sand and manure. The large boiler that used to be at the Nursery was carted to the garden and installed as a soil sterilizer. All the work connected with the building-in of the boiler, as well as building the lath house and extra shed room, was done by the regular men at the garden, the wood used being in part from the old nursery fence, in part from the old quarters removed from the Nuuanu Station.

We have found the sterilizer of great benefit in destroying weeds and insects, etc., that happen to be in the soil. All the soil used for seed boxes and potting at the garden and also at the Nursery, is sterilized. The sterilizing is done by steaming. A grating is placed across the boiler about eight inches from the bottom, the space under the grating being filled with water. The soil is put into the kerosene tins and placed on top of the grating. A close-fitting wooden lid prevents the heat and steam from getting out too freely. From three to four hours is sufficient to cook and kill everything in the soil, without harming it.

We have on hand a large number of plants new to the Territory, most of which are getting ready to plant out. When the trial ground is finished, the plants will be planted and carefully studied.

No plants will be allowed to leave the garden until we are absolutely sure that they will not become pests. We do not have any plants so far that are likely to become pests. On the contrary, they have proved to be beneficial in the countries from which they were sent. Sometimes, however, plants assume different habits when transferred from one country to another—sometimes better, but often worse—hence the reason for care and study before distributing.

About a year ago the Honorable A. de Souza Canavarro, Consul-General for Portugal, delivered to us a number of cuttings of the basket willow which he received from some of the Portuguese immigrants. This plant is used for making all sorts of baskets. The cuttings were planted in the garden and are doing exceedingly well. Cuttings will be available for distribution in a few months. They ought to be planted in moist places, preferably along the sides of streams.

We have a large number of plants at the garden introduced by Mr. Gerrit P. Wilder, which include flowering, forest and fruit trees. Three new varieties of coconuts are also among his introductions.

A large number of the new and rare plants raised from seed received from different Botanic Gardens are all worthy of being given a trial, and some of them may become of great value to the Territory.



Plate 9. Native Undergrowth Coming Up Under a Planted Forest.

A good deal of the time of the men at the Garden has been taken up in assisting in the raising of trees for general distribution, also for Arbor Day. The additions to the buildings and other improvements which have been done has also taken up much time. No more additions or improvements are necessary at present, so that the men can now devote all their time to the care of the plants and getting the trial grounds ready for planting.

TANTALUS FOREST.

During the summer of 1909, which was exceptionally dry, the danger of fires starting in the forest became apparent and steps had to be taken to eliminate the danger. The floor of the forest was covered in most places with a dense tangle of dead and dying lantana, which might have been ignited by people passing through the forest.

To protect the forest from this danger all the laborers employed by the Division of Forestry at the Nursery and Makiki Garden were taken up to the forest one day each week to beat and cut down the lantana and lay it as flat on the ground as possible. This work continued for from three to four months. After it was done the forest was practically safe from fire, for should a fire have got started after the lantana was beaten and trampled down flat it would have burned slowly and been easily put out. The forest now is safe from fires, the ground being covered in most parts by honohono (*Commelina nudiflora*) and air plant (*Bryophyllum calycinum*). The lantana has disappeared with the exception of a few shoots that have come up here and there from the old roots.

The dead wood has been cut down and carted away. About 50 Eucalyptus trees have been cut down for testing purposes and for making volume tables. The forest is now in good condition, very few dead trees are to be found.

The Ranger, David Kapihi, has done good work in keeping the trails through the forest in good shape; also the trails running along the bottom of Makiki Valley and over to the opposite ridge. Other work which he has to attend to, is to look out for people who sneak into the forest every now and again and cut and cart away grass and sometimes trees. He is also supposed to be on the ground when people have dry grass or weeds, etc., to burn off.

During the year 1909, twenty-two permits were issued to people desiring to burn dry grass, brush, etc. The number of permits issued for same purpose during 1910 was seventeen.

NUUANU STATION.

One man has been employed at the station from January 1, 1909, to December 31, 1910. At the latter date it was deemed necessary to dispense with his services. After this there will be no one at the Station, but the water-tender at the dam has promised to keep a lookout and report when anything is wrong. The work done by the man during the last two years consisted principally of clearing away vines from the trees and patrolling the forest in search of estrays, etc.

It may be necessary again to employ one or two men in the near future to keep in check the vine *Maile Pilau* and other vines from smothering the trees. At present the forest is in a healthy condition and making a fast growth. The *Eucalyptus robusta* has proved itself well adapted for this situation. This tree is doing better than any of the other species planted.

Places where previously the ti plant and ferns were almost gone before the trees were planted, are now assuming the appearance of a typical Hawaiian forest, as far as the undergrowth is concerned. Ferns, ti leaf and vines are sprouting up in some places and covering the ground completely. This condition is particularly noticeable where the upper road from the old quarters joins the Pali road. Where the Hilo grass is very dense, however, it is difficult for the natural undergrowth to get a hold.

The old quarters were taken down and carted to Makiki. This was done because of the buildings being on the site of the new reservoir. The wood and iron roofing has been advantageously used at Makiki for different purposes. Two of the houses used by Mr. L. Whitehouse for his men when building the dam were left, an agreement to that effect having been made between Mr. Campbell and Mr. Whitehouse. Should there be more tree planting done in Nuuanu, the houses will come in handy for the men.

Respectfully submitted,

DAVID HAUGHS,

Forest Nurseryman.

Report of the Botanical Assistant.

Honolulu, T. H., December 31, 1910.

Mr. R. S. Hosmer,
Superintendent of Forestry,
Honolulu, T. H.

Sir:—I have the honor to submit herewith my report for the biennial period ending December 31, 1910.

Since October, 1908, I have been engaged by the Board of Agriculture and Forestry with the view to investigate the Flora of these Islands and to establish an herbarium comprising not only native forest trees and shrubs, but also all lower Cryptogams, as well as grasses, pulses and ferns.

Before going any further, I shall try to give an introductory explanation of the nature of an herbarium, its practical uses, and the necessity for systematic work on plants, as well as for forest protection, as only through an intimate knowledge of the life histories of our trees and plants which make up our forest shall we be enabled to devise plans for efficient protection.

THE HERBARIUM.

Among the divisions of the Board of Agriculture and Forestry the herbarium occupies a place of great importance, but one that requires some explanation in view of possible misconception. An herbarium is a systematically arranged collection of authentically named dried plants, and is highly essential for instruction and research. It is somewhat of the nature of a museum, a laboratory and a library. As a collection or assemblage of plant material it resembles the museum. It might be included in the laboratory as an essential apparatus without which systematic work on plants is impossible, and as illustrated literature it is a kind of library extremely useful for reference.

First of all, it may be worth stating that no botanist would think of making an herbarium simply for the sake of having a collection. It is in no sense a fad. It is however, sometimes looked upon by the layman as any other collection, as of perhaps, china cups, postage stamps, or any other objects of someone's passion.

It is in the first place necessary that the herbarium should contain authentically named specimens, as it is not always possible to recognize plants by the brief descriptions which are sometimes published in various languages. Illustrative material is

absolutely necessary to determine the plants of one's own environment and to be able to recognize species new to science. The determination of plant species is by no means the sole factor in botanical work, but is of subsidiary importance. An herbarium may be consulted for a particular specimen, the name of which may be known beforehand in order to compare its structure with other forms, or to ascertain the relationship of an unknown plant.

The herbarium may be compared to a great illustrated volume, to the pages of which the botanist refers daily in quest of information. The administration of such an herbarium may be paralleled in the management of an office, as that of registry of deeds.

The herbarium of this Board is not extended indefinitely beyond the borderlands of the Pacific, but comprises only such Floras as are closely related with the Flora of these Islands. Only in a few cases it was found necessary to have Floras, such as of Mauritius and other islands having an insular Flora, for of island floras botanists distinguish two kinds, "insular" and "continental" floras.

As research in Hawaii is not limited to certain fields of systematic botany, as forest trees, but also is extended to grasses and pulses, it was found necessary to make the herbarium general in its scope, and it was desired that it should contain all the lower Cryptogams, as well as Phanerogams, for purposes of instruction and in order to give a general conspectus of the plants of these Islands. An herbarium should be looked upon, not as a show piece or an accomplished task, but as a growing and working mechanism that will return daily a large interest by way of instruction and research upon the capital invested in its establishment and maintenance.

It being an impossibility to conduct such work without facilities for publication, it therefore may not be out of place to make a few general remarks regarding such. The dissemination of knowledge about plants is the very essence of botanical research activity. Unless the results of research are made known to the scientific world through some precise announcement, they are of no value whatsoever.

A station like the Board of Agriculture and Forestry should be engaged in the publication of original scientific investigations, as well as of popular or semi-popular treatises, such as lists of stock-poisoning plants, pests, etc., occurring in the Territory, with ample illustrations in order to enable the ranchman to recognize his enemies and deal with them accordingly.

It is indeed of the greatest importance and advantage for an establishment of this kind to control its own publication to the extent of at least one or two bulletins, thus giving it the oppor-

tunity to express freely its individuality. I therefore recommend and urge this Board to find means whereby we will be enabled to publish at least one series of bulletins, which shall appear whenever there is material on hand, either scientific or popular. By the freedom of exchange such contributions form the most useful and practical medium of communication between different institutions of the world, and will help to promote and advertise, as well as make the world acquainted with the work accomplished by the Station in question.

FOREST AND BOTANICAL EXHIBIT.

During the month of January, 1909, it was decided by the Hawaii Commissioners of the Alaska-Yukon-Pacific Exposition to send a forestry and botanical exhibit to the Exposition.

The collecting of the wood specimens forming a part of the forestry exhibit and the arrangement of the botanical display was entrusted to me. At the suggestion that the Punaluu Mountains would be the best place from which to secure Oahu specimens, permission was secured from the Trustees of the Bishop Estate, as well as from Mr. J. B. Castle, to proceed to Punaluu Camp and there cut the desired number of trees.

On February 1, 1909, according to instructions, I went to the above named place, camping there for several days, and cutting about forty logs, including duplicates. Ten natives were employed for nearly a week. The hauling of the large logs to the railroad track was not only difficult, but exceedingly dangerous. They had to be carried from an elevation of 2500 feet over a narrow, zigzag foot trail, cut into the face of a precipitous cliff, which, during the continuous rain at that time prevailing, was in almost impassable condition, two landslides having occurred at the time. Besides the logs, herbarium material of 500 specimens was collected.

On February 11, I proceeded in company with one of the Commissioners, Mr. A. F. Knudsen, to Kauai, going to Waimea. Immediately after arrival I started for the mountains accompanied by several natives, Mr. Knudsen following the next day. Halemanu mountain-house was made headquarters. Most of the trees cut for wood specimens came from Kapiwai forest, which is rather open and more accessible than the forest back of Halemanu, besides being drier, and therefore richer in species.

From Halemanu I made trips into the interior of Kauai, visiting Kalalau and Kilohana, where the beautiful *Wilkesia gymnorhynchium* Gray, (Iliau) (see plate 10) is to be found in company with Lobelias. The great bog of Lehua makanoe, with its fragrant endemic violets and insect-eating plant *Drosera longifolia*, a native of Europe, was explored, as well as Mohihi, Alakai

swamp, besides the drier districts, as Milolii, etc. Large botanical material was collected at the above named localities besides seeds and a few wood specimens.

The work having been completed at that section of the island, I proceeded to Makaweli. Mr. Francis Gay, who takes great interest in the native flora and who, I would say, is the authority on native plant names—as well as Meles and Oliolis, in which such names occur—rendered great assistance in straightening out the native names of the Kauaian plants. He is extremely well posted and has gained information from the old Hawaiians that can be had from no one else.

Kaholuamano, Mr. Gay's mountain house, is on the leeward side of Kauai at an elevation of 3800 feet, back of Waimea. There I made my headquarters. I had the good fortune to have Mr. Gay's company for several days, which enabled me to get much data concerning native names of plants and their medicinal properties, as well as Meles and Oliolis, in which some of them occur. Fourteen days were spent at that locality making trips to Lehua makanoe, Mahana, etc. On March 12, I returned with four pack mules loaded with botanical material, to Makaweli. In the drier lowlands and gulches a number of logs were collected for wood specimens.

On March 20, I proceeded to Lihue. On account of the limited time and heavy rains I was unable to camp in the woods back of Lihue, but worked part of the Hauapu range, ascending Hauapu proper, shortly afterwards returning to Honolulu.

After my arrival on Oahu, I proceeded to the windward side of said Island, making Waiahole my headquarters, with a view of collecting additional wood specimens, as well as to secure herbarium material.

During the months of April and May I worked on the botanical exhibit. Four koa stands with swinging frames (see plate 11) were made by Mr. Ira Eskew, then of Kamehameha School. Each stand carried two rows of fifteen double frames each; in all 240 specimens. Stand one contained specimens of Hawaiian Algae (*Limu*) in the upper row and the native ferns in the lower. Stands two and three contained specimens of native shrubs and trees, and stand four introduced ornamental plants. Three koa frames were made for the wood specimens (see plate 12), each one exhibiting thirty specimens, the individual specimen measuring one foot in length, five inches in width, and one inch in thickness, showing the bark on one side.

A gold medal was awarded for the above described Forestry and Botanical Exhibit by the Alaska-Yukon-Pacific Exposition.

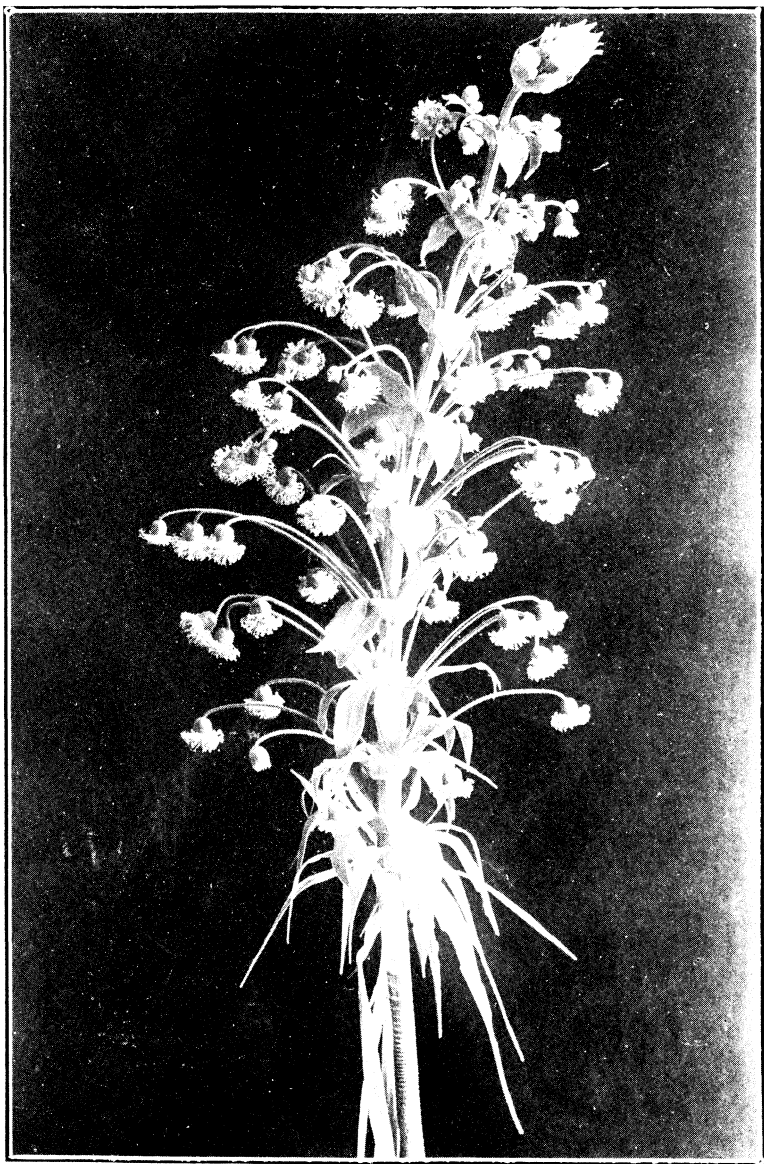


Plate 10. *Wilkesia gymnoxyphium* Gray. *Photo by A. Gortley*
Length of flower about $3\frac{1}{2}$ feet.

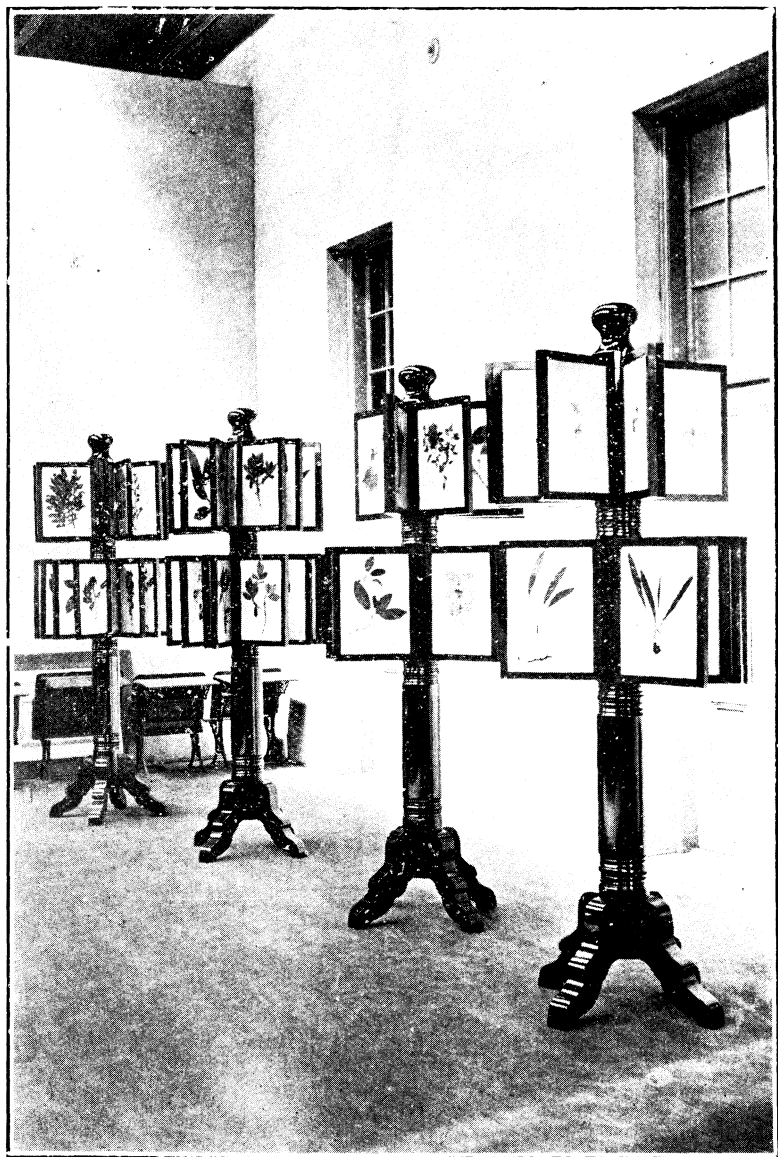


Plate 11. Plant Specimens for Alaska-Yukon-Pacific
Exposition.

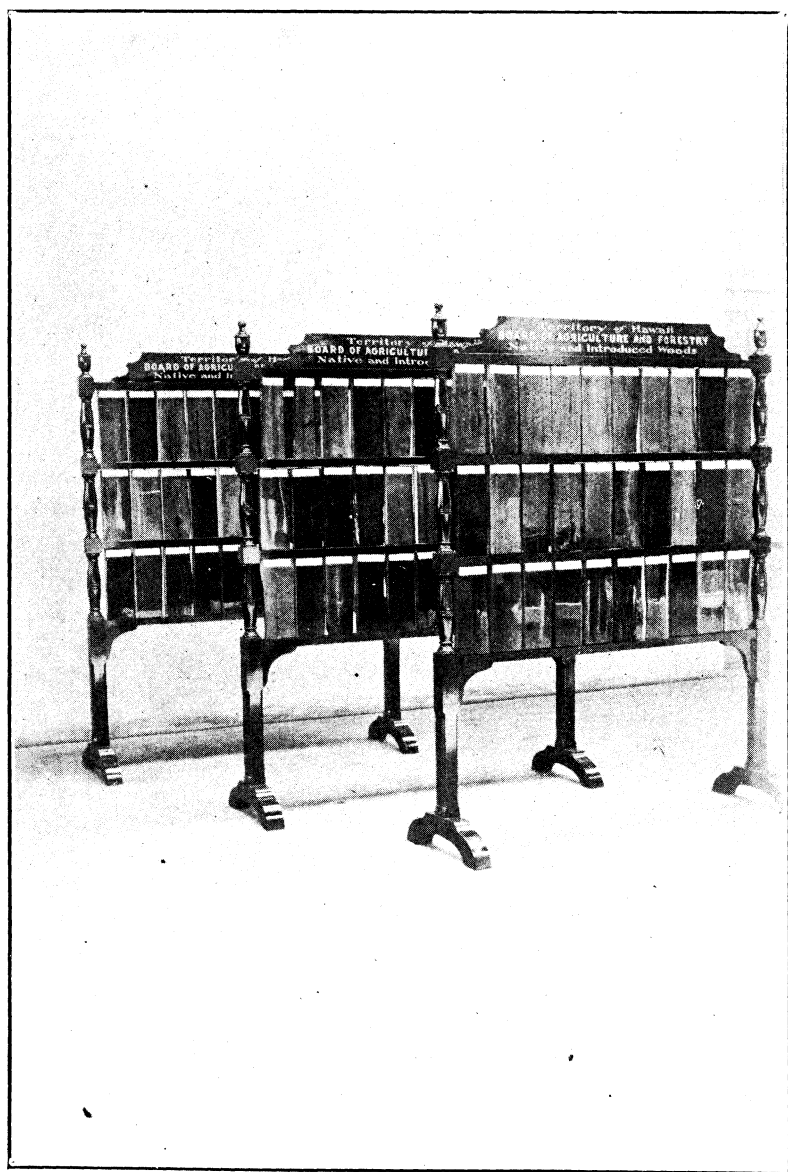


Plate 12. Wood Specimens, Exhibited at Seattle.

BOTANICAL EXPLORATIONS.

NORTH KONA, HAWAII.

On June 1, 1909, I left Honolulu on the S. S. Mauna Loa for Kailua, Hawaii, to make a botanical survey of Mt. Hualalai, as well as to explore parts of the Parker Ranch and Hamakua.

Headquarters were established at Mr. John Maguire's Huchue Ranch, situated at an elevation of 2000 feet on the slopes of Hualalai. The time from June 3 to June 7, inclusive, was spent in collecting, at an elevation of 2000 feet, in the vicinity of Huchue, mainly along the government road. The forest along the road is intersected by two large a-a flows, as well as pahochoe lava flows dating back to the last eruption of Hualalai, in 1801.

It may not be out of place to give a general description of that most interesting of all districts, including Puuwaawaa.

The most prevailing tree near Huchue is *Plectronia odorata* (Walahoe or Alahee), belonging to the order *Rubiaceae*, which has, besides the coffee, one other representative at this elevation, the "Nau" of the natives (*Gardenia brighami*), which on account of its large white and fragrant flowers is worthy of cultivation. The latter was not previously recorded from Hawaii.

A few trees of the Hame or Haa (*Antidesma platyphyllum*), without blossom or fruit, were found near a large Kukui grove, while only 500 feet higher the same tree was found loaded with the black ripe berries. Another species belonging to the *Euphorbiaceae*, *Euphorbia lorifolia*, or Akoko of the natives, who make charcoal of its wood, was seen on a-a lava fields; here it formed a small, straggling shrub of about four feet, while 700 feet higher it is a tree of considerable size, with a trunk of almost ten inches in diameter. A rosaceous shrub (*Ostomeles anthyllidifolia*), Ulei, grew nearby. On the more exposed places *Reynoldsia sandwicensis*, the "Ohe," a representative of the order *Araliaceae*, is abundant on the a-a lava fields. The most common of the shrubs is the native Kului, (*Nototrichium sandwicense*). It forms a hedge on both sides of the government road. Its foliage is of a silvery gray which blends with the color of the lava. The Lama (*Maba sandwicensis*), a very handsome tree of small size, is quite common. Aalii (*Dodonaea criocarpa*), a shrub 6-8 feet in height, grows on open places which are destitute of other vegetation. *Myoporum sandwicense*, or Naio, is predominant on the roadside.

One of the most interesting and rare trees is *Gossypium dryarioides*, the native brown cotton, "Kokio" (see plate 13), Hillebrand in his "Flora of the Hawaiian Islands," says: "The species was imperfectly described by Seeman from a specimen

in the British museum, collected by Nelson, the companion of Captain Cook." North Kona, Hawaii, is a new locality, as the species had only been recorded from the western end of Molokai. In the latter place the writer found one single tree of this species still bearing fruits, but almost dead.

On Hawaii about six of these trees are alive and are much taller than the one on Molokai, having a straight trunk with an average height of 25 feet; one trunk measured 12 inches in diameter. One tree was dead, and the others, if not properly protected, will soon be a thing of the past, as the natives had stripped several trunks of their bark, which contains a rich reddish-brown sap used by them for dyeing their fish-nets. The species is of striking beauty when in blossom and deserves to be cultivated.

Another handsome tree is *Colubrina oppositifolia*, whose wood surpasses that of its relative *Alphitonia ponderosa*, the Kauila from Kauai, in being harder grained and in possessing a deeper red color.

The Uhihi (*Mezoncureum Kauaiense*) is quite plentiful, one tree being of especially large size. The wood is highly prized by the natives, it being the hardest and heaviest of all native woods. Its color is almost black. The winged, papery pods are destroyed by a species of Tortrix (?).

The Alaa (*Sideroxylon sandwicense*) is occasionally met with. It is a handsome tree, of considerable size. On Kauai, where the tree reaches a greater height than in Kona, I found it destitute of fruit with the exception of a few abortive ones, while at North Kona, Hawaii, the tree is loaded with berries of the size of a Chinese orange.

The lava flow of 1801 is bare of vegetation, with the exception of Ohia lehua (*Metrosideros polymorpha*), of which single trees have come up, some of them only 12 to 15 inches high, already bearing flowers and fruit. The hardness of the tree is remarkable, and where nothing else can live, not even the Mamani (*Sophora chrysophylla*), the Ohia lehua adapts itself to almost any condition and environment. It is found in the black bogs of Lehua makanoe on Kauai, as well as in the swamps of the Kohala Mountains, Hawaii. At the former place it is dwarfed, reaching only a height of 6 to 8 inches, and bearing flowers and fruit. It thrives well in the hottest and driest regions, on bare lava as well as in black, muddy soil, at 4000 to 5000 feet, in company with *Acacia Koa*. Where it reaches its greatest height it sometimes exceeds 100 feet. Again, it can be found at the summit of Hualalai, 8200 feet elevation, growing at the rim of a crater, stunted and rugose throughout.

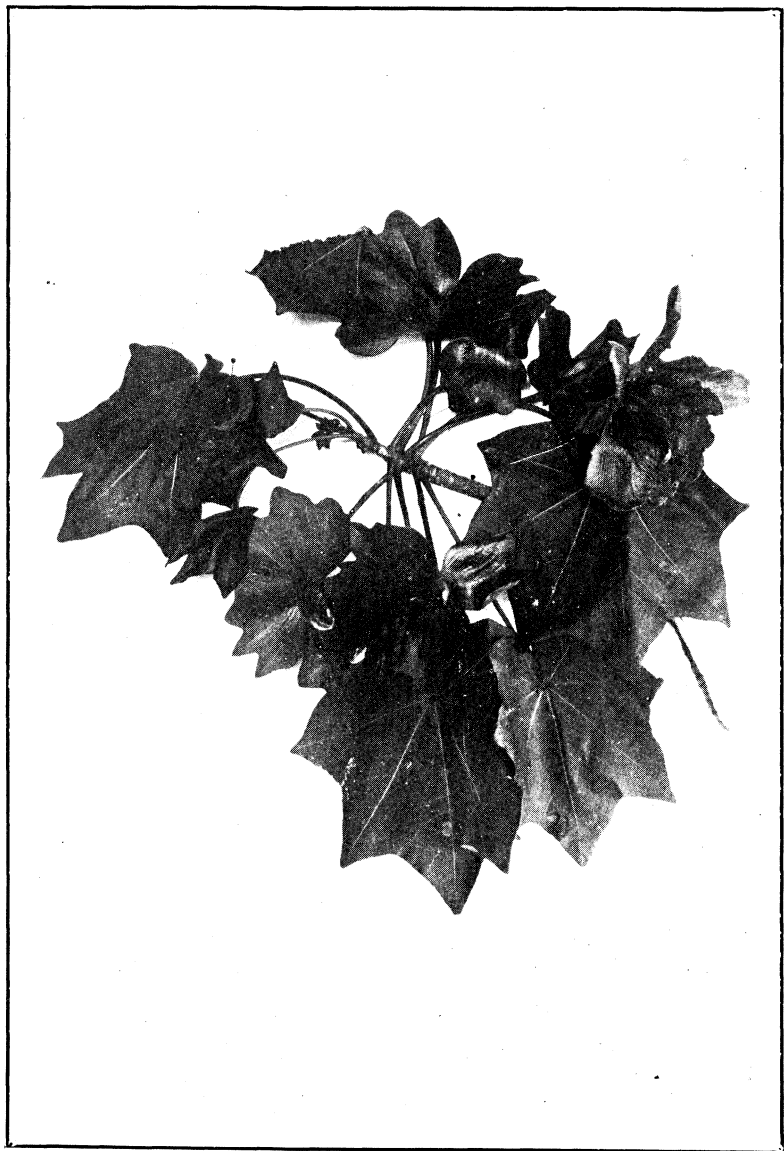


Plate 13. Hawaiian Red Cotton: Kokio.
Gossypium drynarioides Seem.

Of the *Urticaceae*, the Mamake (*Pipturus albidus*), Maoloa (*Neraudia melastomaeifolia*), and Wauke (*Brousonettia papyrifera*) are here represented. The Wauke, which was used by the natives for making their tapa, or paper cloth, was extensively cultivated in former days. It is only found at the settlement of Puuanahulu in the midst of a Cactus hedge.

A few adaptive characteristics of the plant covering of this hot and dry district may be mentioned before this paragraph is dismissed. The prevailing type of wood is of a hard, close-grained texture, such as that of *Mezconcurum Kauaiense*, *Columbrina oppositifolia*, and *Acacia Koaia*, the latter being found on the dry slopes of Puuanahulu; also *Maba sandwicensis*, *Plectronia odorata*, *Sophora crysophylla*, and others.

It appears that in this dry, rocky region the tendency for trees and shrubs of slow growth is to form harder and finer wood than those of rapid growth.

PUUWAAWAA.

The greatest variety of trees and shrubs is found on the little hill called Puuwaawaa, and in its vicinity. This 300-foot hill, rising at an elevation of 2700 feet, is like an oasis in a desert, the like of which can be found in the upper regions of Hualalai. Rough a-a surrounds its base, while on its slopes luxurious vegetation grows in the rich, dark soil, bearing some resemblance to the plant covering of Waihou and the middle forest belt of Mt. Hualalai.

The Olopua, or Pua (*Olea sandwicensis*), a handsome tree, is found on its lower slopes near the edge of the lava fields in company with a Sapindus, an apparently underscribed species. *Charpentiera ovata* and *Pisonia incrmis*, both very soft wooded trees, called Papala by the natives, can be found here in company with representatives of the order *Rutaceae*.

Pittosporum Hosmeri, a species new to science, (see plate 20 and description in part), called Aawa hua kukui by the natives, on account of the large fruits resembling the Kukui nuts, is a common tree in this region. It is astonishing that a tree as common as the above mentioned *Pittosporum* should have been overlooked. It can only be assumed that the region in question had never been visited by any collector or botanist.

The mature fruits of said *Pittosporum* are of enormous size with woody capsule of $3\frac{1}{2} \times 2\frac{1}{2}$ inches.

HUALALAI.

On June 8, preparations were made for the ascent of Hualalai, where camp was established at Kalulu, an elevation of 6000 feet.

While at this camp I experienced a slight earthquake, which was felt stronger at Huelue. On June 9, the ascent was made to Honuaulu, the highest peak of Hualalai, 8273 feet, of which I shall give a general account and description of the country traversed.

At 2000 feet elevation commences the lower forest zone, with valuable pasture lands extending up to about 3500 feet, beyond which the soil is black and muddy and covered by a forest mainly composed of Ohia lehua, Kolea (*Myrsine Lessertiana*), *Byronia Sandwicensis* and *Acacia Koa*, forming the middle forest zone. Most of these Koa trees are nearly smothered beneath great masses of runners of the wild raspberry (*Rubus macraci*), the stems of which are sometimes over two inches thick and 25 feet long, thus forming impenetrable thickets.

From 5000 to 6000 feet the vegetation is stunted, the most prevailing trees being again Ohia lehua and Kolea. Above it the vegetation gives place to lava fields of rough a-a, which gradually pass into a small, dismal plain composed of Pahoehoe and gravelly sand. Here is the home of *Geranium cuneatum*, the wild strawberry (*Fragaria chilensis*), species of *Raillardia* and *Coprosma crnodooides* or Kukaineenee, whose black berries are eaten by the native geese (*Bernicla sandwicensis*).

The vegetation now takes a different character. A leguminous tree, the Mamani of the natives (*Sophora chrysophylla*), and the Naio (*Myoporum sandwicense*), which forms here a tree of 25 to 30 feet in height, are abundant, while at lower elevations both are small, 5 to 6 feet high, and branching from the base. The plain above as well as the forest beneath is intersected by lava streams. Here and there in the extensive lava fields are beautiful green hills covered with old giants of *Acacia Koa*, which, from their elevation, escaped destruction by the fiery streams, and now appear like oases in a desert. From here to about 7400 feet, within which lies the upper forest zone, Mamani and Naio seem to be the only trees, while *Dodonaea eriocarpa*, *Cyathodes tamciameia*, and *Coprosma Menziesii* form the scrub vegetation up to the summit.

The summit itself is composed of a number of large craters, some 200 to 500 feet deep by 3000 feet in circumference—Honuaulu forming, as before mentioned, the highest point, 8273 feet above sea level. The walls of the craters are solid and almost perpendicular, the bottoms flat and gravelly. Some of the craters were full of lava blocks which have fallen from the steep walls.

Northwest from Honuaulu, a half mile distant, are a series of craters and cones, one being especially remarkable for its unfathomable depth. It is a veritable chimney about 100 feet high,

and composed of rough a-a with a blow-hole of 10 feet in diameter, the inner walls of which are perfectly smooth, only one side having fallen in. A stone dropped by the writer into this chimney fell for 16 seconds before the first reverberation could be heard. Between this cone and Honuauulu is a plain covered with a thin crust of lava which breaks at every step.

The slopes of Hualalai, from the Puuwaawaa side, are very steep and bear only one crater of considerable size, at an elevation of 5000 feet.

On June 15, I proceeded to Puuwaawaa, where headquarters were established. Trips were made into Waihou forest, Puuanahulu, and across the extensive lava fields. On June 20, another ascent was made to the summit of Hualalai from its northern slope.

During my stay in North Kona I collected several thousand herbarium specimens, and also made a supplementary collection of the following woods:

Manele	<i>Sapindus</i> sp. (?)
Olei	<i>Ochrosia sandwicensis</i>
Ohe	<i>Reynoldsia sandwicensis</i>
Aica	<i>Nothoestrum breviflorum</i>
Papala	<i>Charpentiera ovata</i>
Akoko	<i>Euphorbia lorifolia</i>
Coffee	<i>Coffea arabica</i>
Aawa hua Kukui	<i>Pittosporum Hosmeri</i>
Papala kepau	<i>Pisonia inermis</i>
Kopiko ula	<i>Straussia hawaiiensis</i>
Kokio	<i>Gossypium drynarioides</i>
Nau	<i>Gardenia brighami</i>
Kauila	<i>Colubrina oppositifolia</i>
Alani	<i>Pelea cinerea</i> var. <i>delta</i>
A'e	<i>Xanthoxylum kauaiense</i> var.
A'e	<i>Xanthoxylum dipetalum</i> var.
Aalii	<i>Dodonaea criocarpa</i>
Pukeawe	<i>Cyathodes tanciamcia</i>
Pilo	<i>Coprosma rhynchocarpa</i>
Naenae	<i>Dubautia plantaginica</i>
Ohe	<i>Tetraplasandra</i> sp. (?)
Uhiuhi	<i>Mezconcurum Kauaiense</i>
Poola	<i>Claoxylon sandwicense</i>
Kului	<i>Nototrichium sandwicense</i>
Maoloa	<i>Neraudia mclastomacfolia</i>
Iliahi	<i>Santalum freycinetianum</i> var.
Opuhe	<i>Urera sandwicensis</i>
Alaa	<i>Sideroxylon</i> sp. (?)
Ulei	<i>Osteomeles anthyllidifolia</i>
Momona	<i>Anona cherimolia</i>

WAIMEA.

On June 21, I proceeded to Waimea via Keaumoku. At Makahalau, in the central part of Parker Ranch, I camped for twelve days, searching the paddocks for stock-poisoning plants, as well as making a general survey of its vegetation. During that time the following places were carefully gone over: Nienie, Mana, Kanahiokaoka, Paauhau Nos. 1, 2, 3, Puuohia, Punohu, Palihookapapa, Wahinekea, Kapepe, Kipukoa, Puupueo, Hancipoe, Puuhuluhulu, Kaluamakani, and Moano on the slopes of Mauna Kea.

July 5, I returned to Waimea, from which point an expedition was made into the swamps of the South Kohala Mountains and to the crater Puukawaiwai. July 9 was spent in a trip from Waimea to the head of the Holokaiea Gulch, which yielded much interesting material.

On July 10 and 11 I followed the upper ditch trail leading to Alakahi and Kawainui to an elevation of 4050 feet. An attempt was made to reach the summit of that range, but could not be carried out on account of the extensive bogs.

On July 15, I went from Waimea to Kukuilaele, where headquarters were established at the Hamakua Ditch Company. July 16, a collecting trip was made into Waipio Gulch proper, as well as into the smaller valleys, as Hiilawe, Waima, Alakahi and Kawainui, on the windward side of Hawaii. July 18, a trip was made into the woods above Hiilawe and Puakalehua Gulch, which is really a continuation of Hiilawe. Nearly all the above mentioned places had never been visited by any collector or botanist. July 20, I crossed Waipio and followed the trail leading to Waimanu. July 22, I returned to Honolulu with several thousand specimens of plants.

EXPLORATION ON KAUAI.

On July 31, 1909, I left once more for the island of Kauai, going immediately after arrival at Makaweli up to Kaholuamano, Mr. Gay's mountain house. All the *Lobelias* were then in blossom as well as many other plants. I explored the great bog of Lehua makanoë, and proceeded into the interior of the island, collecting at Waiakalipo, Waiakealoha, Kahana Valley, etc. As only one botanist, Dr. Wawra, of the Austrian Exploring Expedition, had ever visited Waialeale, the summit of Kauai, and that in the first half of the last century, I found it advisable to arrange an expedition to said mountain. With a guide and three natives carrying botanical outfit, blankets and provisions for one week (including two hundred pounds of poi for the natives) we started for Keaku, a cave at an elevation of 4800 feet, made by



Plate 14. *Lobelia Kauaensis* (Gray) Heller.
Habitat, Mt. Waialeale, Kauai.

natives in the olden times who spent months at a time in that locality hunting birds. The beauty of the surrounding country is almost indescribable. The dense jungle of tropical vegetation uncontaminated by civilization, with its many gay-colored birds feeding on the exquisite giant-lobelias, the beautiful streams of refreshing water, bordered by the immense Ape ape (*Gunnera petaloidea*) whose leaves are sometimes 5 ft. in diameter, with an inflorescence of nearly 4 ft. in length, is a picture which will ever be held in memory by him who was so fortunate to see it, and even more fortunate to collect in such virgin forest.

After crossing Wailenalena stream we came to the high central plateau where thousands of the most beautiful of all Hawaiian Lobelias, the "Pue" (*Lobelia kauaensis*) (see plate 14) and "Kolii" (*Lobelia macrostachys*) formed the main vegetation. Late at evening, long after the sun had set, we had still two miles to walk, and that in the stream-bed of Kaluiti and Kailili, between boulders, and every now and then climbing over the sides of a waterfall, finally reaching the Cave Keaku, situated on the slopes of Kaluiti Valley, hidden under vines and ferns.

The writer spent five days in that locality exploring the forest and ascending the summit of Kauai, "Waialeale"—an extensive open swamp constantly enwrapped by clouds and harboring most interesting plants. There are to be found the "Mikinalo" (*Drosera longifolia*) the insect-eating plant, Giant Lobelias, Violets, Geraniums, strange grasses, and peculiar woody composites. Among them was one species new to science (see description and plate) besides *Cyperaceae*; also an Umbellifera and many other plants.

Heavily laden with rare and interesting material I returned to Kaholuamano where I spent several days in straightening out the plants collected. My native guide, an old Hawaiian, was well versed in the native folklore, and through him I was able to secure Meles and Oliolis about the plants of "Waialeale."

During the first week in October I explored the beautiful cañon Olokele, which yielded material of great interest. The work having been completed, I returned to Honolulu, only to start again for Kauai on October 14. Mr. Marshall, Chief Geographer, U. S. Geological Survey, was to visit the island and I was to accompany him as guide. Taking advantage of the opportunity I took some of my botanical outfit along, with the intention of collecting wherever we would go. We first proceeded to Lihue, from there to Hanalei and then to Kekaha; afterward, camping at Halemanu, at Malua Poha, Mr. Fave's mountain house. Trips were made to Kilohana, Kalalau, and into Alakai swamp. After an absence of ten days we returned to Honolulu.

During the months of November and December, 1909, and January, 1910, I was engaged in classifying the plants collected on previous trips.

VISIT TO MOLOKAI.

On February 15, 1910, I proceeded, according to instructions, to the island of Molokai, with the view of collecting botanical material as well as to investigate the forage plants on the Molokai Ranch, especially the stock-poisoning plants. I spent ten days at Kamoku camp, collected along the main ridge, in Kawela swamp, Pelekunu Pali and along the ridge to Wailau, where extensive collections were made comprising all species and classes of plants found in that region.

From Kauluwai, after several days spent in search for obnoxious weeds, as well as grasses—making, so to say, a botanical survey of the pasture lands—I proceeded to the Leper Settlement and to Kalawao where most interesting shore-plants were collected. The trip to the Settlement was made mainly to explore the valleys back of the same, as well as Waikolu, which have been explored very little botanically. Two new species were found in the latter which will be described in the near future. The western end of Molokai, which seemed to offer very little botanically, was a great surprise, as nearly as much material was collected there as at Pelekunu.

After having completed that section of the island I proceeded to Mapulehu. From there all the valleys on the leeward side were explored, as well as another ascent made to Pelekunu from Kamalo. A trip was made across the Mapulehu Pali near Puu Wailau into Wailau Valley proper, on the old native trail. Several days were spent in the valley and an attempt was made to climb Olokui, the highest peak in that section, but on account of the heavy rains, which made the crossing of the stream dangerous, and the unwillingness of the natives to accompany me, the trip was given up and I returned to Mapulehu over the Wailau Pali and from there started for Halawa, where the extensive swamps back of the Twin falls were explored, as well as the valley itself. The preliminary botanical work for that season having been completed on Molokai the writer returned to Honolulu on April 29.

The number of specimens collected during the Molokai trip amount to approximately 3,000. Besides flowering plants, and forage plants and grasses, a great number of lichens, mosses, ferns, etc., were collected, which have been forwarded to the various specialists in Europe for identification.

KOHALA, HAWAII.

In the month of May, 1910, I proceeded to Hawaii, landing at Kawaihae and going at once to Waiki, where an investigation was made of the different pasture grasses and poisonous plants. Mauna Kea was ascended three times from Waiki and interesting material secured.



Plate 15. *Brighamia insignis* Gray.

Native names—Puaala on Molokai; Alulu on Niihau. Growing on the cliffs at Halawa, Molokai.

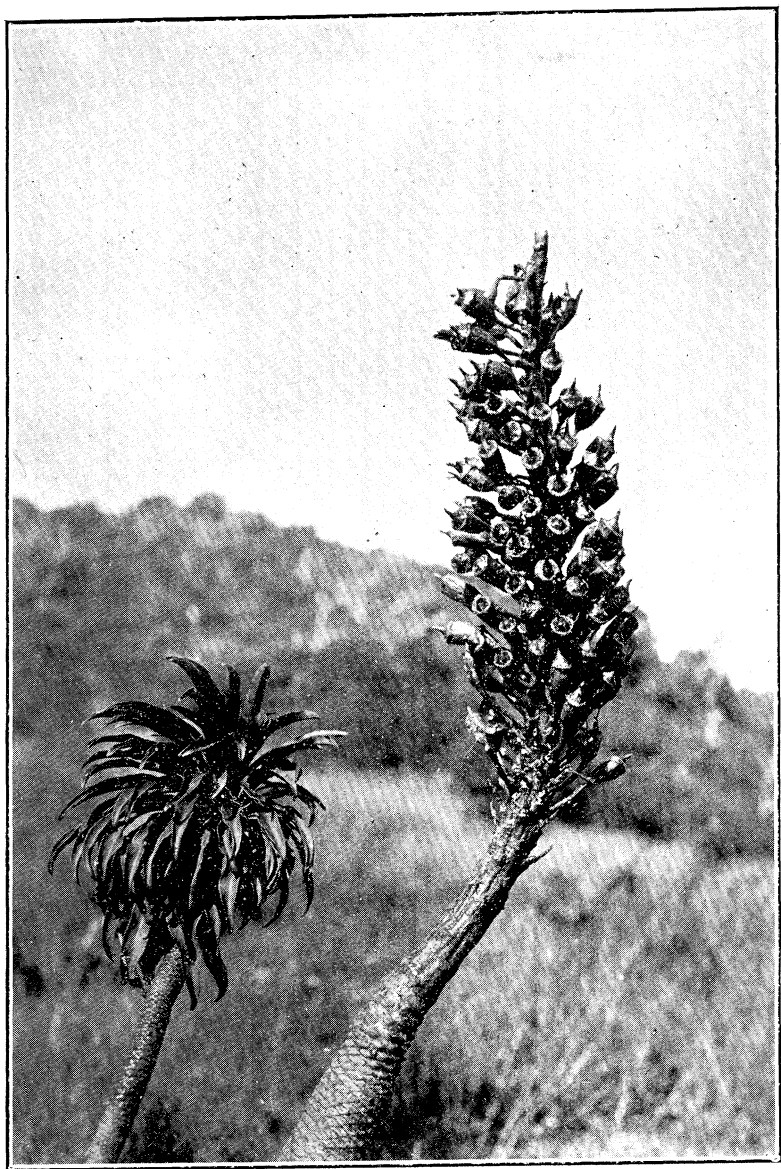


Plate 16. *Lobelia Gaudichaudii* DC.

Fruiting specimen; growing on Pelekunu Pali, Molokai, at an elevation of 4500 feet.

Waimea plains, respectively, Makahalau, Nienie, Mana, Haneipoe, Paauhau No. 1, 2 and 3, Nohonoohae and other paddocks were searched for stock-poisoning plants as well as other undesirable weeds and grasses of which a complete set authentically named, with a typewritten history of each plant will be given to the Parker Ranch in the near future.

Mauna Kea was again ascended from Kemole, Kaluamakani, and from Nau, near Horner's Ranch, as the vegetation at the higher levels varies considerably in the different localities. The woods back of Waimea were explored again, especially Alakahi and Kawainui.

Then in North Kohala, the lower ditch was followed up, way into the heart of the mountains back of Honokanenui, Pololu, etc. Twice the attempt to cross the intervening gulches from Kohala to Awini had to be postponed on account of the swollen streams, which made the passing with pack mules not only dangerous, but impossible. Finally I reached Awini, and from there proceeded afoot for several miles into the woods, carrying botanical outfit, provisions, etc.; camping there five days. From this point the summit of Kohala was reached after having cut a sort of trail through the swampy jungle. The botanical gain from that locality was immense. A number of new species were discovered, among them a violet which covered the ground thickly, and which scented the air with fragrance. It grew in an open, flat swamp, resembling somewhat *Lchua makanoc* of Kauai.

Mauna Kea and Kohala mountain yielded about 3500 specimens, some of which are new, besides a large number of lower Cryptogams.

Returning to Honolulu on June 25, I was occupied from June 26 to July 18 in partly arranging the large material collected on the different trips.

TRIP TO LANAI AND WEST MAUI.

On July 19 it was thought advisable to visit the Island of Lanai, having made arrangements with Mr. J. T. McCrosson and Mr. Chas. Gay previously. Mr. Marston Campbell consented to have Mr. J. G. Hammond, a local teacher, accompany me. Mr. Hammond had had experience in collecting plants, etc., and was therefore a great help in the field, his duty being the drying of blotters and labelling, as well as collecting plants.

Lanai was thoroughly explored from the summit Lanaihale to Kaa; the valleys Maunalei and Nahoku, the two largest ones, were visited besides Mahana and Kaiholena and the small gulches on the slope of the main ridge.

A new violet was discovered on the main ridge, that seems to be peculiar to Lanai. It is woody, three feet high, with pink

flowers and narrow lanceolate leaves. The dry districts were of the greatest interest, especially the valley of Kailolena. Here also several new species were discovered. The material collected on the Island of Lanai comprises about 2500 specimens; the largest amount of species of Lichens were found on that Island. After a month's sojourn on Lanai I left the Island for Lahaina on the "Nunulawekeka," a whale-boat carrying the U. S. mail between Halepalaua and Lahaina, Maui.

Through the courtesies of Mr. Weinzheimer, manager of the Pioneer plantation, in supplying men and pack mules, I was enabled to ascend the highest peak on West Maui, Puu Kukui, 5788 feet elevation. Camp was pitched at an elevation of 4200 feet on the edge of Honokawai gulch. From there the summit could be reached in four hours' walk through the swampy jungle. Puu Kukui is of greatest interest, its vegetation being of similar character as Waialeale of Kauai, elevation 5250 feet, which mountain I ascended the previous year. With exception of the insect-eating plant *Drosera longifolia* and a new species of Composite, since described by me in The Torrey Botanical Club Bulletin, the flora is practically the same. Though several plants are peculiar to Puu Kukui as a violet, lobelia, and several others, I was greatly surprised in finding the Silversword, or Ahinahina of the natives, known from Haleakala and Mauna Kea, at the summit of West Maui, growing in a veritable pool. As the plant was not in flower it was impossible to determine if the same is a new species or not, but it may be an intermediate form of the green silversword from the western slopes of Haleakala and the well-known silversword from the crater and Mauna Kea. About 1000 specimens were secured on this trip.

EXPLORATION OF HALEAKALA.

Having returned to Honolulu the latter part of August, on September 23, 1910, a trip was made to East Maui in compliance with instructions to explore the slopes as well as the crater of Haleakala.

The first camp was pitched near Olinda at Mr. Fred. Harvey's survey camp. From there the forest of Hamakuapoko was explored as best as conditions permitted; from Waikamoi to Puo-haokamoa and to the headwaters of Honomanu, where the jungle is dense and the vegetation exceedingly tropical; large material was secured at that locality.

The camp was then transferred to Ukulele Dairy, 1000 feet higher than Olinda. The upper slopes of Haleakala, whose vegetation consists mainly of shrubby, woody composites and geraniums, besides a large number of plants belonging to other endemic genera, were traversed in all directions.

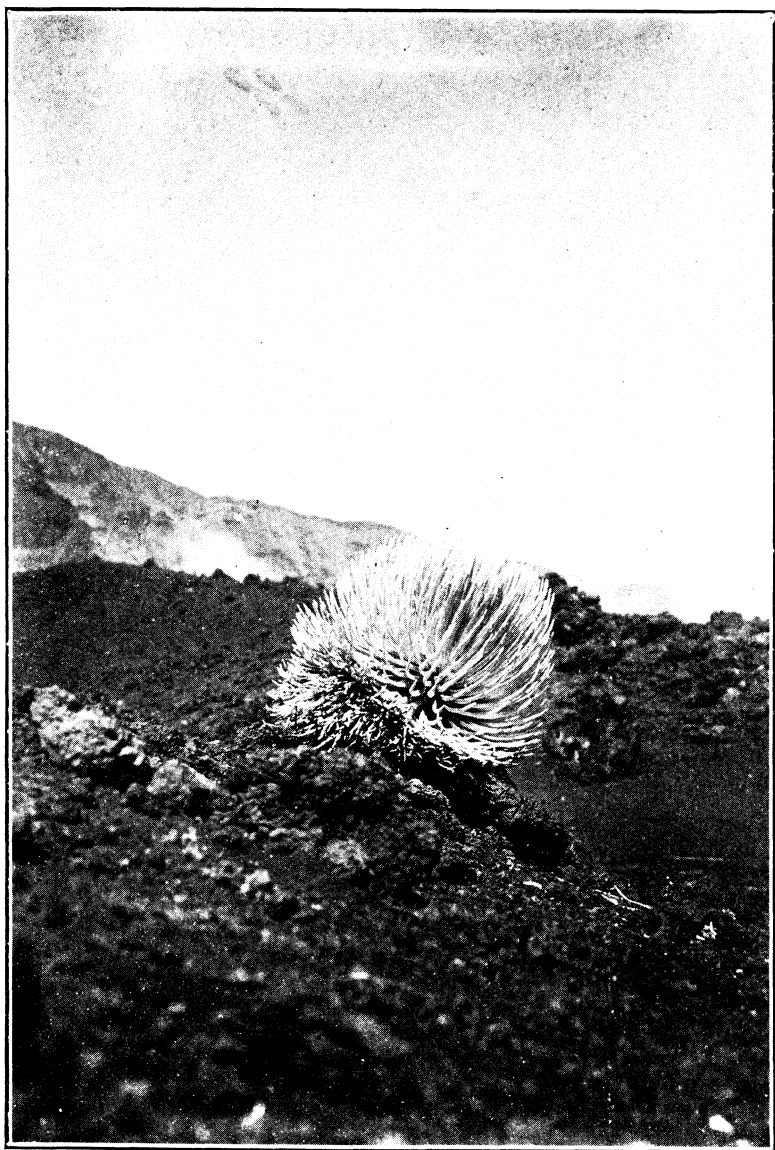


Plate 17. *Argyroxiphium Sandwicense* DC.
Beta var. *macrocephalum* Hbd.

Silver Sword—Ahinahina—in Haleakala crater, Maui.



Plate 18. *Argyroxiphium Sandwicense* DC.
Beta var. *macrocephalum* Hbd.
Silver Sword in flower—Ahinahina.

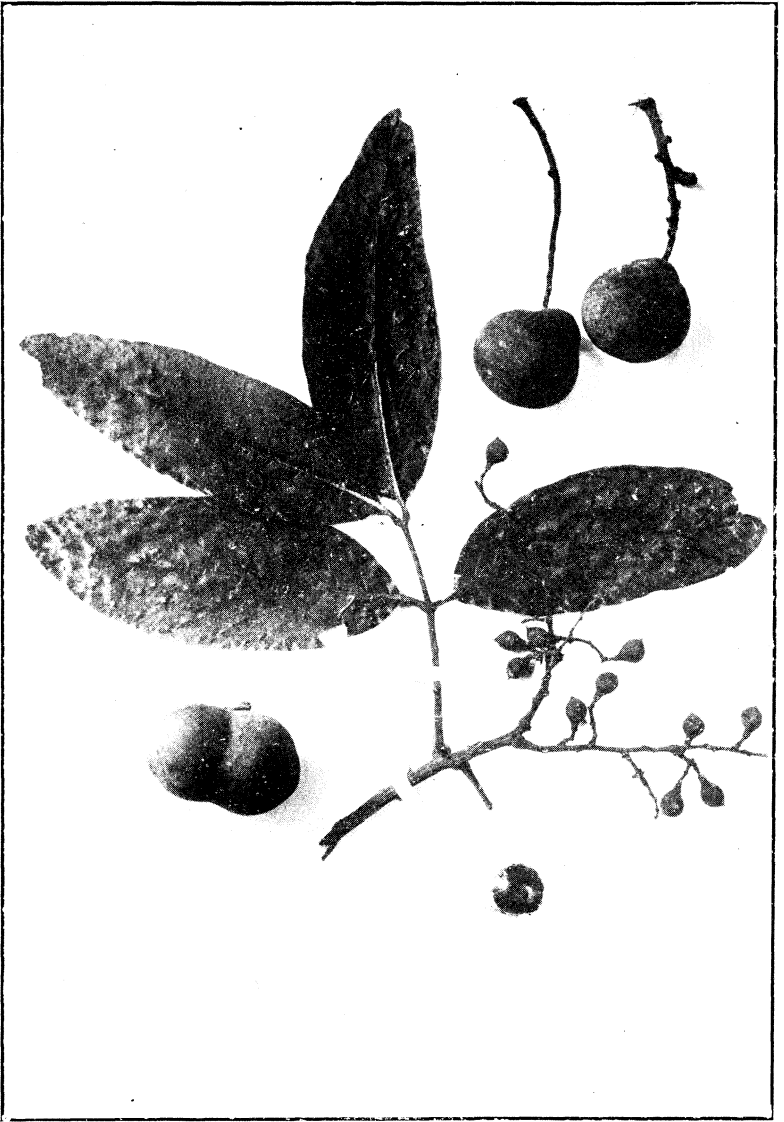


Plate 19. *Alectryon macrococcum* Radlk.
Mahoe. Showing young and mature fruits, and seed. Slightly
less than one-third natural size.

On October 24, Mr. L. von Tempsky, Mr. Sam Baldwin and I descended into the crater and camped in Kaupo Gap for five days. The crater was crossed from Kaupo to Koolau, and as much material as the short time permitted was collected. After the return from Koolau Gap the flora of the Makawao forest and of Puukakae was investigated and found to yield very interesting species, among them a species of Noni (*Morinda trimera*), only previously collected by Mr. Lydgate fifty years ago. One tree only was observed; rediscovered by Mr. L. von Tempsky.

ULUPALAKUA.

Going on to Ulupalakua, Dr. Raymond's ranch, a study was made of the different Eucalypts originally planted by Captain Makee. Auahi and Kahikinui, seven miles from Ulupalakua, where I stopped for twelve days, was the most interesting field ever visited by me on any island, with the exception of Puuwaawaa, Hawaii. On an area of 350 acres not less than 47 species of trees were observed. Special mention may be made of one tree, thought to be extinct since the time of Hillebrand. This tree, belonging to the order of *Sapindaceae*, possesses an edible fruit, of the size of a large potato, and is worthy of cultivation. About forty trees were observed and mature seeds of the same collected; it is called Mahoe by the natives, and was described by L. Radlkofer in the Sitz. math.-phys. bayer. Akad. Wiss. XX. 1890; the name, *Alectryon macroccocum*. (See plate 19).

Auahi and Kahikinui on Maui may be compared, and that justly, to Puuwaawaa on Hawaii. Nowhere in the group, with the possible exception of certain small areas in Kau, Hawaii, not yet visited by me, is there such a variety of species to be found as in these two localities. Both places have much in common, though each has its peculiar species. *Gossypium drynarioides*, the red native cotton, is also present at Auahi, previously thought to be growing only on West Molokai. The genera *Pittosporum*, *Pelea*, and others have most interesting representatives at Auahi, Maui, as well as at Puuwaawaa, Hawaii.

I returned from this trip to Maui early in December, since when I have been occupied with the classification of the plants collected in the above described trips.

The number of specimens in the herbarium amounts to approximately 20,000 sheets, including duplicates. Over 1000 were received through exchange with foreign countries, representing genera of plants closely allied to Hawaiian genera.

COLLECTION OF NATIVE SEED.

On Kauai and at Puuwaawaa, Hawaii, as well as at Kahikinui, Maui, the writer was enabled to collect seed of some forty-five native species, amounting to over 100 pounds.

EXCHANGE OF HERBARIUM SPECIMENS.

For over a year the writer has been in correspondence with the leading herbaria of Europe, America, and the different Botanic Institutions in the Orient and Australia in regard to the exchange of herbarium specimens.

At present the Department has exchanged with the Sydney National Herbarium, New South Wales; Botanic Gardens, Peradenya, Ceylon, India; Botanic Gardens, Buitenzorg, Java; Herbarium Bureau of Science, Manila, P. I., and Botanic Station, Mauritius.

The following institutions have consented to exchange: Paris, Jardine du Plant, Tahitian flora; Imper. Roy. Nat. Hist. Museum, Vienna, Austria, Samoan material; Herbarium British Museum, London, Fiji material; Botanic Station, Taihoku, Formosa, Formosan plants; Berkeley, Cal., Herbarium, California plants; New York Bot. Gardens, Bronx Park, West Indian and Central American material; Botanic Station, Sipur, near Calcutta, Indian plants; Botanic Gardens, Singapore, Malayan plants.

INVESTIGATION OF STOCK-POISONING PLANTS.

As soon as the large material of pasture plants, grasses, etc., in this herbarium can be worked up, an account will then be published in popular language, with ample illustrations, describing the obnoxious as well as useful pasture plants occurring in the Territory, so that every ranchman will be enabled to recognize a plant as his friend or enemy, and deal with it accordingly.

EUCALYPTUS INVESTIGATION.

The writer has made a special effort to straighten out the different species of Eucalypts growing in the Islands. On Tantalus material from 40 species and varieties was collected and forwarded to Dr. J. H. Maiden, Government Botanist, Sydney, New South Wales, Australia, the Eucalyptus expert, who kindly consented to identify the same for the Department. The diagnosis of over 20 species he has sent lately. Of the remaining ones, Dr. Maiden requested more complete material. This has been

forwarded to him, as well as to Dr. Baker, who inquired if he could obtain specimens of the various species of Eucalypts cultivated in the Islands. The identification of the latter is still pending. Of natural grown Eucalypts in Australia the Herbarium contains an almost complete set, authentically named.

PLANTS NEW TO SCIENCE.

In the mountains at Punaluu, Oahu, at an elevation of 2000 feet, on August 24, 1908, I discovered and collected specimens of one tree new to science belonging to the genus *Euphorbia* and of one violet. These, together with a plant belonging to the genus *Lysimachia*, have been described by C. N. Forbes of the Bishop Museum, Honolulu, in the Occasional Papers of that Institution, as *Euphorbia Rockii*, *Viola oahuensis*, and *Lysimachia longisepala*. The first two, *Euphorbia* and *Viola*, were collected by me (August 24, 1908). The *Lysimachia* he obtained when in company with me at Punaluu, November 14-21, 1908, and not as given by him, on August 14-21, 1908; his first four specimens having been collected by me.

It may be remarked that Mr. Forbes overlooked the creeping rhizome in *Lysimachia longisepala*, which my co-type specimens, collected November 14-21, 1908, plainly show.

Besides the above, the following plants new to science were discovered and described by the writer, with exception of *Sideroxylon rhynchospermum*, which was first collected by Dr. H. L. Lyon of Honolulu.

Scaevola Swezeyana Rock Bull. Torr. Bot. Cl., 36:645, 1909.

A shrub 9-12 dm. high, with stiff, glabrous, rambling branches. Leaves glabrous, oblanceolate, 38-76 mm. \times 12-18 mm., on petioles 6-13 mm. long, mucronate, entire, somewhat fleshy; peduncle single-flowered, 4-6 mm. long, entire, slightly pubescent, with two oblanceolate, foliaceous bracts below the calyx 6-18 mm. long by 2 mm. broad; calyx 4 mm., glabrous, with short, bluntish teeth of unequal size; corolla pubescent, 5-lobed, yellowish green with reddish brown streaks; tube 18 mm. long, erect, corolla-lobes linear-lanceolate, sharp-pointed, scarcely margined, 16 mm. \times 3 mm.; stamens somewhat longer than the tube; style incurved, pubescent throughout, little shorter than the corolla, indusium glabrous, ciliate; drupe glabrous, crowned by the calyx-teeth, 5-6 mm., two-celled, putamen black, crustaceous.

The type is No. 4804 (in the herbarium of the Board of Agriculture and Forestry), collected in the woods on the middle ridge

of Niu Valley, Oahu, at an elevation of 1200 feet (August 22, 1909). The species is named in honor of Mr. O. H. Swezey of the Hawaiian Sugar Planters' Experiment Station.

Pittosporum Hosmeri Rock Bull. Torr. Bot. Cl., 37:297, 1910.

Arbor 6.5-10 m. alta, ramis robustis; folia coriacea, 90-125 mm. longa, 18-38 mm. lata, oblanceolata, obtuse acuminata, supra glabra, subtus lanuginosa, petiolo tomentoso 12-25 mm. longo; capsulae maturae 3 aut 4 in pedunculo 12-20 mm. longo, lignosae, glabrae, oblongo-subquadrangulatae, 55-75 mm. longae, 45 mm. latae; semina nigra, rugosa, 6-7 mm. diam.

A tree 6.5-10 m. high, with a straight trunk and rather stout branches, young shoots pubescent; leaves crowded at the ends of the branches, coriaceous, 90-125 mm. \times 18-38 mm., oblanceolate, bluntly acuminate, the upper side glabrous and wrinkled with a close net-work, covered underneath with a silvery gray wool, entire, gradually narrowing into a pubescent petiole of 12-25 mm.; open mature capsules single or 3 or 4 on a woody peduncle of 12-20 mm. and pedicels of 2 mm., thick-woody, oblong to subquadrangular, 55-75 mm. \times 45 mm., opening into two, three, or sometimes four valves with a longitudinal median groove, glabrous when old, covered with a grayish brown wool when young; endocarp bright orange-colored, seeds black, rugose, 6-7 mm. in diameter. The fruits exude a milky glutinous sap. Flowers not collected.

This tree is rather common on the lava fields of Puuwaawaa, Hawaii, at an elevation of 3000 feet. The species is remarkable for the unusually large, woody capsules which open into two, three, and sometimes four valves. (Native name Aawa lua kukui.)

The type number is 3957 in the herbarium of the Board of Commissioners of Agriculture and Forestry, Territory of Hawaii. Collected at an elevation of 3000 feet. (*J. F. Rock*, June 17, 1909.)

Sideroxylon rhynchospermum Rock Bull. Torr. Cl. 37:297, '10.

Arbor 10-20 m. alta; folia coriacea, obovato-oblonga, 14-18 cm. longa, 4.5-8 cm. lata, petiolo 2.5-3 cm. longo, alterna, stipulis 0, prorsus glabra, folia novella tomentosa; calyx fere usque ad basin partitus, segmentis 5, acuminatis, imbricatis; corolla lutea, campanulata, lobis 5; stamina glabra, ad basin corollae affixa; stylus brevis; bacca ovoidea, purpurea vel nigra 4.5-5.5 cm. \times 3.5-4 cm.; semina 3-5, testa crustacea nitida, plana rostrata, 25-30 mm. longa, 12-14 mm. lata.

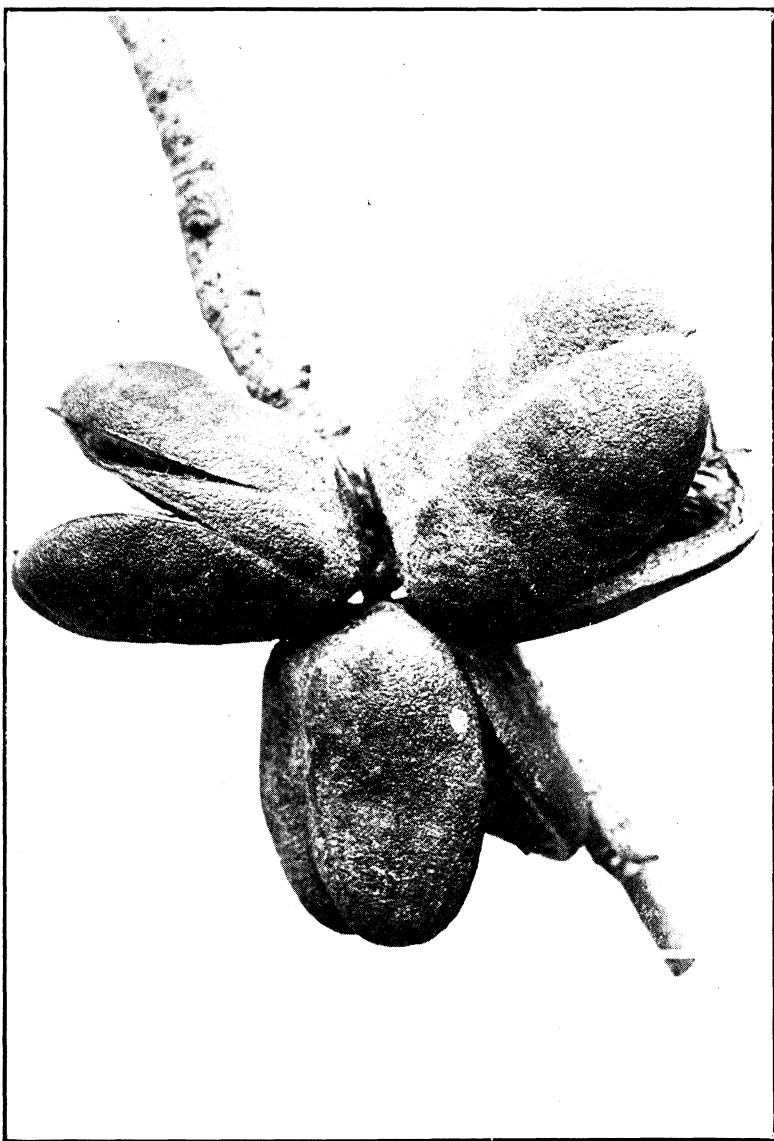


Plate 20. *Pittosporum Hosmeri* Rock.
About four-fifths of the natural size.

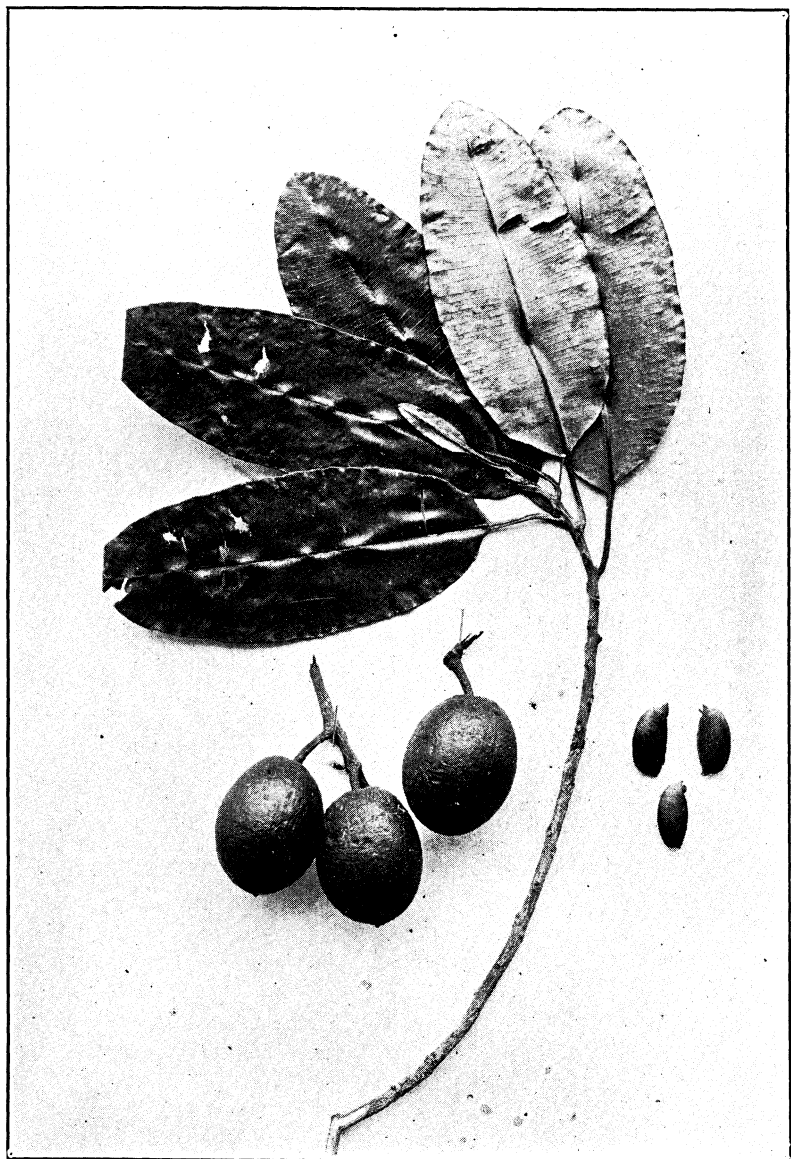


Plate 21. *Sideroxylon rhynchospermum* Rock.
About two-fifths of the natural size.

A tree 10 m.-20 m. high, dividing freely into ascending branches; bark brownish, with shallow, narrow longitudinal corrugations about 3 mm. thick, trunk up to 45 cm. in diameter four feet from the ground; leaves coriaceous, obovate-oblong, 14-18 cm. \times 4.5-8 cm., on petioles of 2.5-3 cm., alternate, estipulate, quite glabrous with age, some pubescence remaining on the sides and angles of the midrib and veins, especially on the lower surface, shining above, dull beneath, midrib prominent, with lateral veins leaving midrib at wide angles (about 80° in center of leaf) parallel to margin and connected by a continuous intramarginal nerve, young leaves densely covered with appressed brown hair on both surfaces; flowers in clusters 2 or 3 (?) on tomentose pedicels, 12-20 mm. long; calyx 5-parted to near the base, lobes imbricate, acuminate, 3-5 mm.; corolla light yellow, longer than the calyx, 4-5 parted to the base, lobes acute; staminodia half as long as the lobes, linear, with a faint nerve; stamens 5, inserted at the base of the corolla, glabrous; anthers erect, ovate, the cells confluent at the apex, opening laterally; ovary hirsute, 5-celled, style short-conical; fruit a purple or black plum-like berry 4.5-5.5 cm. \times 3.5-4 cm., rather fleshy, 3-5-seeded; seeds enclosed in a papery pyrena, 25-30 mm. \times 12-14 mm., flat, beaked at both ends of the ventral angle, which is occupied by the scar of the raphe, the crustaceous testa thin, of a light brown color.

This tree was discovered by Dr. H. L. Lyon, pathologist of the Hawaiian Sugar Planters' Experiment Station, in the woods of Nahiku, Maui, at an elevation of 1300 feet, where he collected the type material. Dr. Lyon observed one large tree at Kailua, Maui, which had a straight trunk fully 30 feet to the first branch.

The type is number 6061, given by Dr. Lyon for the herbarium of the Board of Commissioners of Agriculture and Forestry, collected January 15, 1909, at Nahiku, Island of Maui.

Lysimachia glutinosa Rock Bull. Torr. Bot. Cl. 37:300, 1910.

Frutex 10-12 dm. altus; folia alterna, chartacea, obovato-oblonga, acuminate, 38-102 mm. longa, 12-30 mm. lata, petiolis longitudine 12 mm.; pedicelli axillares, ex axillis foliorum superiorum; calyx fere usque ad basin partitus; corollae rotato-campanulatae, albae, lobis 5-8, ovatis; capsula lignosa, ovata, 5-10 valvis dehiscens; semina numerosa.

A diffusely branching shrub 10-12 dm. high, glutinous; leaves alternate, chartaceous, entire, obovate-oblong, acuminate, 38-102 mm. \times 12-30 mm., narrowing into a winged petiole of 12 mm., upper face covered with a glutinous exudation, underneath glabrous and pale with prominent nerves; inflorescence viscid; flow-

ers solitary in the axils of the upper leaves on pedicels of 38 mm. (50-76 mm. when with fruit); calyx persistent, with ovate-lanceolate acute lobes free to near base, and half the length of the corolla, punctate; the imbricate corolla large, rotate-campulate, cream-colored, 25-38 mm. in diameter, cut deeply into 5-8 ovate lobes, tube 4 mm. long; stamens half the length of the corolla or little more, the rather long filaments united at the base by a granular membrane, anthers erect; style little shorter than the stamens; capsule ovoid, smooth, 12 mm. or more long, lignescent, glossy inside, opening by 5-10 valves; seeds numerous.

This plant is sometimes covered with hair, flies, and dirt, which adhere to the very viscid inflorescence and leaves; the large, showy flowers are of striking beauty (February to March). In the herbarium the dried specimens leave large oil spots on the paper.

The type is number 1770, in the herbarium of the Board of Agriculture and Forestry of the Territory of Hawaii, collected on the highest ridge west of Halemanu, Kauai, on rather open places at an elevation of 4500 feet (February 14, 1909). A few shrubs were seen in the woods back of Kalalau.

Dubautia Waialealae Rock, Bull. Torr. Bot. Cl. 37:304, 1910.

Planta hirsuta, 2-3 dm. alta; folia coriacea, 15-20 mm. longa, 4-6 mm. lata, terna, sessilia, oblanceolata; capitula 5-10 mm. diam., hirsuta, in pedicellis 4-27 mm. longis; corymbus foliaceus; involucrium angustum, bracteis 5-6; receptaculum conicum, hirsutum; corollae luteae; pappi paleae lanceolatae, ciliatae; achaenia parce pilosa.

Whole plant hirsute, 2-3 dm. high, with stout, woody branches covered with leaf-scars throughout; leaves thick-coriaceous, crowded, 15-20 mm. \times 4-6 mm., ternate, sessile, oblanceolate, acute, narrowing below, remotely denticulate in the upper half, covered with small, stiff, whitish hairs on both sides, many-nerved; flower-heads 5-10 mm. in diameter, hirsute on pedicels of 4-27 mm. in groups of 4-18 at the ends of the branches, corymb foliaceous; involucrial bracts 5 or 6, almost as high as the heads; receptacle conical, covered with long, white hairs; florets 6-30; corolla bright yellow, slightly exserted, deeply 5-cleft, lobes reflexed; pappus chaffy, the narrow lanceolate ciliate paleae as long as the hispid straight achenes.

The type number is 5030 in the herbarium of the Board of Agriculture and Forestry of the Territory of Hawaii; collected (September 24, 1909) at the summit of Mt. Waialeale, Kauai, at an elevation of 5250 feet, where the plant grows in company with *Geranium humile*, *Lobelia kauaensis*, *Pelca Waialealae*, and *Drosera longifolia*.



Plate 22. *Dubautia Waialealae* Rock.
Less than one-half the natural size.

HERBARIUM EXTENSION.

The herbarium is exceedingly crowded for space. Only four herbarium cases have been provided by the Board, which naturally cannot house all of the material so far collected, as well as the plants received by means of exchange. Five big boxes are now filled with plant material. It is exceedingly difficult to work on the collections on account of the limited space. At least four more cases are needed for housing the present collection properly, and in order to protect it from insects, which cannot be done when specimens are stored away in boxes.

The room provided for the herbarium of this Board is altogether too small, and the moving of the same into larger quarters is an imperative necessity, if systematic work is to be carried on properly.

None of the Hawaii plants have as yet been mounted, with exception of the Cyperaceae. All plants received through exchange have been mounted and labeled.

The writer's time has been chiefly occupied in field work. As has been stated before, all Phanerogams, endemic and introduced, as well as ferns, mosses, lichens, fungi, fresh water and marine algae, have been collected in order to make the collection complete. It is the plan of the writer later to compile a complete flora of the Islands comprising all Phanerogams, as well as Cryptogams, with illustrations of the new and noteworthy species, to be published by the Board of Agriculture and Forestry.

The following specialists have kindly consented to work up our Hawaiian Cryptogams, and some of our Phanerogams:

Dr. Alexander Zahlbruckner, Vienna, Austria; Lichens.

Dr. Casimir De Candoll, Geneva, Switzerland; Piperaceae (Peperomia).

Prof. E. Hackel, Attersee, Austria; grasses.

Rev. G. Kückenthal, Koburg, Germany; Cyperaceae.

Dr. A. W. Setchel, Berkeley, California; Algae.

Of the photographs of plants reproduced in this report, all were taken by the writer with the exception of one taken by Mr. A. Gartley.

The writer wishes to express his great indebtedness and sincere thanks to all those who have helped him in his floral search on the various Islands. He is especially indebted to Mr. Francis Gay of Makaweli, Messrs. Augustus F. and Eric A. Knudsen and Mr. Hans P. Faye of Kekaha, Mr. John Maguire of Huehue, Mr. Robert Hind of Puuwaawaa, Dr. B. D. Bond of Kohala, and to Mr. A. W. Carter, manager of the Parker Ranch, to Mr. P. W. P. Bluett of Kohala, Mr. Charles Gay of Lanai, Mr. J.

T. McCrosson of Kukuilhale, Mr. George P. Cooke of Kauluwai, Mr. L. B. Nevin, Mr. James Munroe, Mr. C. C. Conradt, Mr. J. D. McVeigh of Kalaupapa, Mr. J. F. Brown of Halawa, Molokai; Mr. L. von Tempsky of Makawao, Mr. F. E. Harvey, Mr. L. Weinzheimer of Lahaina, Dr. J. H. Raymond, and last but not least, to Mr. A. Dowsett of Ulupalakua, for their kind hospitality and courteous assistance, and without whose aid the investigation of the Hawaiian Flora would have been impossible.

I also wish to express my appreciation and thanks to Mr. J. G. Hammond, who assisted me greatly in the explorations of the Island of Lanai and Puu Kukui on West Maui.

Respectfully submitted,

JOSEPH F. ROCK,
Botanical Assistant.

LIST OF DISTRICT FORESTERS.

(Corrected to February 1, 1911.)

Following is a list of the (thirty-nine) District Foresters with their respective jurisdictions. Those marked with a star (*) have been appointed Special Territorial Police Officers to enforce the Terms of the Wild Bird Law, Act 104 of the Session Laws of 1907:

KAUAI.

* ALBERT S. WILCOX.

In and for the District of Halelea.

J. R. MYERS.

In and for the District of Koolau, excepting the land of Anahola.

* GEORGE H. FAIRCHILD.

In and for the land of Anahola and the northern portion of the District of Puna, extending as far as the land of Wailua.

* F. WEBER.

In and for the portion of the District of Puna, south of and including the land of Wailua, except the lands controlled by Grove Farm Plantation.

* EDWARD BROADBENT.

In and for those lands in the District of Puna, controlled by the Grove Farm Plantation.

REV. J. M. LYDGATE and * WALTER D. McBRYDE.

In and for that portion of the District of Kona, lying to the east of the Hanapepe Valley.

* FRANCIS GAY.

In and for that portion of the District of Kona, lying between and including the Waimea, Poomau and Kauaikanana Valleys on the west and the Hanapepe Valley on the east.

* AUGUSTUS F. KNUDSEN.

In and for the District of Na Pali and that portion of the District of Kona, formerly known as the District of Waimea, lying to the west of the Waimea, Poomau and Kauaikanana Valleys

OAHU.

* ANDREW ADAMS.

In and for the District of Koolauloa.

* L. L. McCANDLESS.

In and for that portion of the District of Koolaupoko extending from Koolauloa to the land of Heeia.

* W. C. WEEDON.

In and for that portion of the District of Koolaupoko extending from and including the land of Heeia to the land of Kailua.

* JOHN HERD.

In and for that portion of the District of Koolaupoko extending from and including the land of Kailua to Makapuu Point.

* PAUL R. ISENBERG.

In and for that portion of the District of Kona extending from Makapuu Point to and including Manoa Valley.

* WALTER F. DILLINGHAM.

In and for the Districts of Ewa and Waianae.

W. W. GOODALE.

In and for the District of Waialua.

MOLOKAI.

* JAMES MUNRO.

In and for that portion of the Island of Molokai lying to the west of Wailau Valley and the land of Mapulehu.

* C. C. CONRADT.

In and for that portion of the Island of Molokai, including and lying to the east of Wailau Valley and the land of Mapulehu.

LANAI.

* CHARLES GAY.

In and for the Island of Lanai.

MAUI.

H. P. BALDWIN.

District Forester at Large for the Island of Maui.

* L. WEINZHEIMER.

In and for the District of Lahaina.

H. B. PENHALLOW.

In and for the District of Wailuku.

* H. A. BALDWIN.

In and for the District of Hamakuapoko and the western half of the District of Hamakualoa.

* W. F. POGUE.

In and for the District of Koolau and the eastern half of the District of Hamakualoa.

* C. J. AUSTIN.

In and for the District of Hana.

* L. VON TEMPSKY.

In and for the District of Makawao.

L. VON TEMPSKY and DR. J. H. RAYMOND.

In and for the Districts of Kula, Honuaula, and the lands beyond to and including Kaupo.

HAWAII.

* G. C. WATT.

In and for the District of North Kohala, and that portion of the District of Hamakua lying between the District of North Kohala and the Waimanu Valley.

* A. W. CARTER.

In and for the District of South Kohala.

* A. AHRENS.

In and for that portion of the District of Hamakua from and including the Waimanu Valley to the District of Hilo.

* JOHN M. ROSS.

In and for that portion of the District of Hilo extending from the District of Hamakua as far as the land of Makahanaloa.

* JOHN A. SCOTT.

In and for that portion of the District of Hilo extending from the District of Puna to and including the land of Kikala.

* JOHN WATT.

In and for the District of Puna.

* JULIAN MONSARRAT.

In and for that portion of the District of Kau extending from the District of Puna to and including the land of Punaluu.

* GEORGE C. HEWITT.

In and for that portion of the District of Kau extending from the land of Punaluu to the District of Kona.

* R. VON S. DOMKOWICZ,

In and for that portion of the District of South Kona extending from the District of Kau to the land of Kaohe.

W. R. CASTLE.

In and for that portion of the District of South Kona extending from and including the land of Kaohe to the District of North Kona.

* JOHN D. PARIS.

In and for that portion of the District of North Kona extending from the District of South Kona to and including the land of Kahaluu.

* JOHN A. MAGUIRE.

In and for that portion of the District of North Kona extending from Kahaluu to the District of South Kohala.

LIST OF DISTRICT FIRE WARDENS.

(Corrected to February 1, 1911.)

Following is a list of the (forty-nine) District Fire Wardens, with their respective Districts:

CHIEF FIRE WARDEN.

RALPH S. HOSMER,

Superintendent of Forestry, *ex officio*.

DEPUTY FIRE WARDEN AT LARGE.

DAVID HAUGHS.

In and for the Territory of Hawaii.

DISTRICT FIRE WARDENS.

KAUAI.

.....

In and for the Wainiha Valley, District of Halelea.

W. F. SANBORN.

In and for the District of Halelea, excepting the Wainiha Valley.

J. R. MYERS.

GEORGE HUDDY,

Assistant District Fire Warden.

In and for the District of Koolau, excepting the land of Anahola.

GEORGE H. FAIRCHILD.

In and for the portion of the Districts of Koolau and Puna, extending from the land of Anahola to the land of Olohena, inclusive.

E. WEBER.

In and for the portion of the District of Puna, south of and including the land of Wailua.

REV. J. M. LYDGATE.

In and for that portion of the District of Kona, formerly known as the District of Koloa.

FRANCIS GAY.

In and for that portion of the District of Kona, lying between and including the Waimea, Poomau and Kauaikanana Valleys on the west and the Hanapepe Valley on the east.

AUGUSTUS F. KNUDSEN.

In and for the District of Na Pali and that portion of the District of Kona, formerly known as the District of Waimea, lying to the west of the Waimea, Poomau and Kauaikanana Valleys.

OAHU.

ANDREW ADAMS.

In and for the District of Koolauloa.

FRANK PAHIA.

In and for that portion of the District of Koolaupoko, extending from the Koolauloa District line to the land of Heeia.

GEORGE CAMPBELL.

In and for that portion of the District of Koolaupoko, extending from and including the land of Heeia to the land of Kailua.

JOHN HERD.

In and for that portion of the District of Koolaupoko, extending from and including the land of Kailua to Makapuu Point.

CHARLES H. BAILEY.

In and for that portion of the District of Kona, extending from Makapuu Point to Palolo Valley.

.....

In and for Palolo Valley, District of Kona.

W. M. GIFFARD.

In and for that portion of the District of Kona, lying between Pauoa and Manoa Valleys.

G. H. MOORE.

In and for Pauoa and Nuuanu Valleys, District of Kona.

WALTER F. DILLINGHAM.

In and for the District of Ewa and that portion of the District of Waianae lying to the East of the Waianae Mountains.

F. MEYER.

In and for that portion of the District of Waianae lying to the West of the Waianae Mountains.

* W. M. TEMPLETON.

In and for the District of Waialua.

MOLOKAI.

JAMES MUNRO.

In and for that portion of the Island of Molokai lying to the West of Wailau Valley and the land of Mapulehu.

C. C. CONRADT.

In and for that portion of the Island of Molokai including and lying to the East of Wailau Valley and the land of Mapulehu.

LANAI.

CHARLES GAY.

In and for the Island of Lanai.

MAUI.

H. P. BALDWIN.

Fire Warden at Large, for the Island of Maui.

L. WEINZHEIMER.

In and for the District of Lahaina.

R. C. SEARLE.

In and for the District of Kaanapali.

H. B. PENHALLOW.

In and for the District of Wailuku.

H. A. BALDWIN.

In and for the District of Hamakuapoko and the west half of the District of Hamakualoa.

W. F. POGUE.

In and for the District of Koolau and the east half of the District of Hamakualoa.

JOHN CHALMERS.

In and for the District of Hana

.....

In and for the District of Kipahulu.

J. H. RAYMOND, M. D.

In and for the Districts of Honuaula and Kahikinui.

L. VON TEMPSKY.

In and for the Districts of Kula and Kaupo.

HAWAII.**G. C. WATT.**

In and for that portion of the north half of the District of Kohala, extending from the land of Kaauhuhu to the Hamakua District line.

SAM P. WOODS.

In and for that portion of North Kohala, extending from the northern boundary of the land of Kawaihea I to and including the land of Kaauhuhu.

SAM M. SPENCER.

In and for the District of South Kohala.

AUGUST AHRENS.

In and for the western part of the District of Hamakua, extending to the boundary of the land of Paauhau.

.....

In and for that portion of the District of Hamakua, extending from the western boundary of the land of Paauhau to the boundary of the land of Kukaiau.

ALBERT HORNER.

In and for that portion of the District of Hamakua, extending from and including the land of Kukaiau to the Hilo District line.

JOHN M. ROSS.

In and for that portion of the District of Hilo, extending from the Hamakua District to the land of Makahanaloa.

JOHN T. MOIR.

In and for that portion of the District of Hilo, extending from and including the land of Makahanaloa to the land of Kikala.

JOHN A. SCOTT.

In and for that portion of the District of Hilo, extending from the Puna District line to and including the land of Kikala.

JOHN WATT.

In and for the District of Puna.

WILLIAM G. OGG.

In and for that portion of the District of Kau, extending from the Puna district line to and including the land of Punaluu.

CARL WOLTERS.

In and for that portion of the District of Kau, extending from the land of Punaluu to the Kona District line.

R. VON S. DOMKOWICZ.

In and for that portion of the District of Kona, extending from the Kau District line to and including the land of Kaapuna.

T. C. WHITE, *Acting*.

In and for that portion of the District of Kona, extending from the land of Kaapuna to and including the land of Hookena.

JOHN D. PARIS.

In and for that portion of the District of Kona, extending from the land of Hookena to and including the land of Kaawaloa.

T. C. WHITE.

In and for that portion of the District of Kona, extending from the land of Kaawaloa to and including the land of Kahaluu.

JOHN A. MAGUIRE.

In and for that portion of the District of Kona, extending from the land of Kahaluu to the Kohala District line.

FOREST RANGER.

DAVID KAPIHE.

In and for that section of the District of Kona, Island of Oahu, bounded on the east by Manoa Valley, on the north by the Konahuanui Mountain Range, on the west by Nuuanu and Pauoa Valleys, and on the south by the makai edge of the Eucalyptus forest, the Makiki reservoir and the mauka boundary of the Judd land in Makiki and Manoa.

Address delivered at Special Conservation Meeting, November, 1910.

THE PART PLAYED BY THE FOREST IN CONSERVATION.

By

RALPH S. HOSMER,
Superintendent of Forestry.

On November 16, 1910, there was held in the Throne Room, at the Capitol, Honolulu, under the joint auspices of the Territorial Board of Agriculture and Forestry and the Hawaiian Sugar Planters' Association, a Special Conservation Meeting to consider some of the fundamental principles of Conservation in their relation to local needs.

The address of the Superintendent of Forestry is reprinted here, as it contains some matter not otherwise available. Mr. Hosmer's address was as follows:

The five cardinal points for which conservation stands are the right use of lands, waters, forests and minerals, and the systematic safeguarding of the public health. Here in Hawaii we are more intimately concerned with conservation than are most communities. With us the very economic life of the islands depends on the wise use of waters, lands and forests. While standing as we do, the western outpost of our nation, this community has placed upon it responsibilities in matters affecting the public health that require a large measure both of zeal and discretion.

My share on this program is to speak of the part that the forest has to play in Hawaii and to point out certain things that must be done, if our local forests are to be made to render their full service to the people of this Territory.

The forest situation in Hawaii is familiar to most of those in this audience. But let me briefly review the salient points. Hawaii is essentially an agricultural community, largely dependent upon irrigation. Under our local conditions of sharply diversified climate, of varied topography and of the need—the more pronounced because of our limited areas—of putting to its highest use every acre of our arable land, it is essential that provision be made for the wise utilization of every drop of water that can be made to do duty—be it used for irrigation, for domestic supply, for fluming cane or for power development.

This can only be accomplished with the aid of the forest. With our short, steep watersheds, heavy rainfall and lack of adequate storage facilities it is self-evident that the function exercised by the forest on the catchment basins and in general over the watersheds, is of much more importance here than in most other countries. Far and away the chief value of the Hawaiian forest is as a protective cover for equalizing and making dependable the sources of our water supply. For retarding run-off, protecting the surface against erosion and helping to form a natural reservoir, from which are fed the streams and springs, it is hard to conceive of a better cover than the dense mass of trees, shrubs, ferns and undergrowth that together make up our native forest. Its value is too evident to require argument.

But under present day conditions such a forest can only be permanently maintained by being cared for. That this may more effectively be done, forest reserves have been created and a general program drawn up looking to the adequate care of the forest. But such a plan takes time to carry into effect and the co-operation of all forest owners, be they the general public, interested as joint owners of the public domain, or more directly, because they themselves control land in fee simple.

A good start has been made, but much of what has so far been accomplished is but preliminary to what waits to be done. Before the house can be built the foundations must be laid. So with the creation of a forest reserve system. The fixing of boundaries, the proclamations, and the coloring in of areas on a map are but steps toward the realization of an ideal. The time has now come in Hawaii when we must go further.

And why is it that we must do this? Why this constantly recurring talk of forests and forest protection? Why not leave it to the government officials to look after the forests? That is what they are paid for.

The answer to these questions is simply and solely because in Hawaii forestry is a business necessity. Wood and water are the first needs that must be satisfied in any community. Both are products of the forest. Wherever it can be got water is the most valuable product that the native Hawaiian forest can be made to yield. In Hawaii, without the native forest we should be without water. And in our planted forests, we have, too, an asset of constantly increasing value; for the production of wood is one of the pressing needs of local conservation.

The truth of these assertions is self-evident. But notwithstanding, there is much delay in putting into practice things which everybody agrees ought to be done to make our forests render their full quota of service. The object of this meeting is to bring home to those on whom rests the duty of managing

the material resources of Hawaii, the fact that wise use means not alone the prevention of waste but as well, and even more, the full utilization of all our resources. The prevention of waste does not mean the locking up of our natural resources. That is no part of the conservation program. On the contrary the keynote of conservation is use. But use from the standpoint of conservation essentially means *wise use*—use by which we may enjoy the benefits from a given resource, not only today but also in the years to come. And in Hawaii this cannot be brought about save through the coöperation of all concerned.

Now obviously the first step in wise use is to stop waste. And unfortunately all over the Territory waste is now going on—waste of waters, of forests and of lands. This is not good business. It must be put an end to. When artesian waters are not needed for actual use the wells must be shut off. Where erosion can be checked by altering the method of cultivation, that must be done. And where the forest by being protected can be made the better to do its part, it is but short-sighted economy that refuses to build the necessary fence.

In an address made at the recent Conservation Congress at St. Paul, Henry S. Graves, Chief Forester of the United States, said: "The practice of forestry by private owners is a public necessity." This declaration is particularly applicable to Hawaii. All the more important of our local forest reserves are made up of both government and privately owned lands. To secure the most efficient management of these areas requires that the owners of the lands coöperate with the government more actively than they now do. The most pressing needs in the forest reserves at present are, in most cases, fencing; in some the extermination of wild cattle and goats; and in others the replacement of the forest on areas where the growing of trees is the best use to which the land can be put. In addition there is always to be considered the planting of waste land with trees of commercial value.

It is no part of the plan of the government to abate its activity in forest work, nor to shirk any responsibilities that rightly belong to its officers. On the contrary it is the desire and intention of the Board of Agriculture and Forestry each year to render more and more efficient service through its several divisions. But it is not enough that the forest officials do their work. Seeing to it that the forests of Hawaii get proper care is a matter quite as much to the interest and benefit of individual land owners and corporations as of the government itself. We cannot hope in this Territory to make our forests do their full duty until all who are charged with their management give evidence of their faith through tangible works.

I am not making this plea on the grounds of abstract altruism. I am merely putting up to you as business men, a business proposition. The time has come when to make the most of our Hawaiian forests there is demanded the active coöperation of all forest owners. The place has been reached where the owners of Hawaiian forests cannot afford not to take active and united steps for the better protection of the forest, both by seeing to it that the appropriate branches of the government are given the adequate financial support by which alone can the government lands be properly administered, and also, and fully as important, by themselves undertaking forest work, each on his own land, but all uniting in a general plan.

It is not enough merely to pass resolutions approving and applauding these projects. The time has come to put words into deeds. Let every plantation manager think of the forest above his plantation. Let every land owner have in mind the condition of his forest holdings. Are your forests, and through them your streams, receiving the protection that the best interests of the plantation demand to be given them? Is there not somewhere a place where a short stretch of fence would shut off and protect a large area of forest? Are there not areas of waste land that if protected would grow up again with native forest, or that could be planted with useful trees of commercial value? These, gentlemen, are practical questions. I put them to you because I believe they are of real and vital moment. Every one can be translated directly into terms of money and everything done is for your own benefit. Can you afford not to take account of these realizable assets?

It is not within the scope of this talk to go into details of what should be done in this or that place, or to prescribe ways and means. By this time every one now in Hawaii likely to need such service, ought to know that the staff of the Division of Forestry is always ready to advise forest owners how best to care for their forests and where, when and how to plant trees on their areas of waste land to get certain desired results. The object today is not to give such advice. What I have tried to do rather, is to set each man thinking if there is not forest work on his own land that if it were done would increase the value of his property; that if it is not done, will result in its depreciation.

I do not forget that much excellent forest work has been done by private interests in Hawaii and that the last year has been marked by a gratifying increase in forest planting by numerous plantation companies. But it is not enough. Every plantation company that has waste land ought each year to plant up definite areas with forest trees quite as regularly as it harvests its cane. It ought also—and of the two this is the more imperative—to

fence off and efficiently protect the areas of native forest from which come its supplies of water. From my knowledge of the Territory I am positive that to incur the expense necessary to get such work started is in every case a good investment. It is for your own interest, gentlemen, that I ask you to give these subjects thought. Forestry in Hawaii is not a matter for any one man or set of men; it is one that in its results affects us all.

The purpose of conservation is so to use the natural resources that first and foremost we ourselves may derive the fullest benefit from them today, but also that we may then pass them on, unimpaired, so that those who come after us may continue to enjoy the same benefits. Let us, here in Hawaii, look to it, each man on his own land, but all working together to a common end, that every one is doing his part to conserve through wise use the most important of our natural resources, the forests and waters of Hawaii nei.

Division of Entomology.

Report of the Superintendent of Entomology for 1909.

Honolulu, Hawaii, December 31, 1909.

Honorable Board of Commissioners of
Agriculture and Forestry of the
Territory of Hawaii.

GENTLEMEN :— I have the honor to submit herewith the sixth report of the Division of Entomology covering the calendar year 1909 and as most of the work during this period was performed by my predecessor, Mr. Jacob Kotinsky, the report must of necessity be more or less a compilation from the reports of the work performed by him and his assistants.

STAFF.

Superintendent.

The position of Superintendent was changed by the Board on October 1st and I was regularly installed as Superintendent at that time and Mr. J. Kotinsky was returned to his former position as Assistant Entomologist under me.

Consulting Entomologist.

Mr. Albert Koebele still holds the position of Consulting Entomologist and has been absent from the Territory, collecting during the year, mostly in Germany, where he has been studying the Hornfly and its parasites in an endeavor to procure such of these, which would prove of benefit to the Islands in checking this terrible pest of our cattle.

Assistant Entomologist.

The position of Assistant Entomologist had remained vacant during 9 months of the current year and was only filled after my appointment as Superintendent by placing Mr. Kotinsky back into his former position, which he held under the late Mr. Alexander Craw.

Inspectors and Assistants.

I am pleased to say that the Division has enjoyed the appointment of two efficient inspectors, Messrs. D. B. Kuhns and L. V. Lewis, who, under direction of the chief, have not only been accurate and faithful in the performance of their respective duties but have greatly improved in their knowledge of Entomology. Mr. Lewis took Mr. Miller's place about the first of August. The large field of inspection enables us to handle insects in nearly every order and necessarily induces closer study in Entomology. The Division has been greatly strengthened by now having its permanent inspectors instead of having to continually change and use untrained extra help, as was previously done, and also by this method less danger now exists of allowing any serious pest to pass us.

Our regular inspector at the Port of Hilo, Brother M. Newell, is still retained and continues to faithfully perform his duties. Our honorary inspectors consisting of Messrs. Robert E. Elgin at Mahukona, Hawaii, W. O. Aiken at Kahului, Maui, W. D. McBryde at Koloa, Kauai, Wm. Robb, Lahaina, Maui, and Dr. W. D. Deas, Hana, Maui, still remain with us and are ready to serve us when occasion requires.

Miss Ella K. Dayton has acted as clerk and stenographer of the Division during most of the year, however, the Board having rearranged the clerical force of all Divisions in November, Miss Melika Peterson has taken up the work so ably performed by Miss Dayton and is giving very good satisfaction, Miss Dayton now having charge of the Library.

LINES OF WORK.

The work which occupies most of our attention and time is the rigid inspection of fruit, plants and vegetables of which enormous quantities are constantly being shipped into the country. Yet after performing this important duty we were able to attend to a few other matters. We have been able to breed, collect and distribute beneficial insects. We also visited various localities, when requested giving advice on methods of combating pests, also in the care of trees and plants horticulturally. Much work in rearranging the Division collection and starting a general slide collection of Scale insects and remounting the Scale insects into permanent mounts has been done. Our aim is to so arrange the collection and so card index the same that the least possible time will be used in determining specimens, which we either find in our inspection or which are sent to us from the various sections of the Islands for identification and advice.

Through the already adopted system of record blanks we are able to know the exact number of vessels and the quantity of live vegetable matter received and the accompanying charts give an account of all the work performed by us and the assistant at Hilo.

DIVISION OF ENTOMOLOGY.

INSPECTION.

HONOLULU.

MONTH.	SHIPS		BAL- LAST	TREATED BEFORE RELEASING		DESTROYED		RETURNED		TOTAL EXAMINED	
	Board- ed	Veg. Bearing		Lots	No.	Lots	No.	Lots	No.	Lots	No.
1909.											
January.....	32	19	1	4	5	29	96	5	405	497	11,112
February.....	25	14	..	35	45	8	10	..	...	419	12,981
March.....	38	22	..	22	22	11	14	2	13	410	8,428
April.....	25	16	..	27	110	7	15	1	5	111	23,997
May.....	37	17	..	23	24	11	15	..	...	532	8,082
June.....	29	16	..	18	33	3	7	1	15	419	5,798
July.....	31	16	1	10	15	12	85	2	112	1004	10,532
August.....	28	21	1	3	6	14	61	..	...	677	13,802
September.....	30	17	..	12	1,068	12	19	3	230	734	17,303
October.....	27	16	..	14	40	14	36	..	...	710	17,311
November.....	30	17	..	9	16	7	12	..	...	877	16,666
December.....	31	17	..	13	23	11	19	..	...	662	14,225
Total.....	363	208	3	190	1,404	139	389	14	780	7,052	160,237
Average.....	...	...	..	16	117	11	32	1	65	588	13,353

HILO INSPECTION.

	Ships In- spected	TREATED		RETURNED		DESTROYED		PASSED		TOTAL INSPECTED	
		Lots	Parcels	Lots	Parcels	Lots	Parcels	Lots	Parcels	Lots	Parcels
January.....	13	3	94	1	5	2	2	186	2,997	192	3,098
February.....											
March.....	11	8	676	..	..	1	2	81	801	90	1,479
April.....	6	..	Few	..	..	..	..	93	1,478	93	1,479
May.....	15	..	...	..	..	..	..	160	2,375	160	2,375
June.....											
July.....	8	..	...	..	..	..	..	125	1,646	125	1,646
August.....	* 7	..	...	..	..	..	..	* 150	* 1,500	* 150	* 1,500
September.....	5	1	3	..	..	..	Small amount	108	1,616	109	1,619
October.....								119	1,988	121	2,043
November.....	9	2	55	..	..	..	..	90	1,507	91	1,528
December.....	* 7	..	...	..	..	1	21				
Total.....	81	14	828	1	5	4	25	1,112	15,908	1,131	16,766
Average.....	6	1	69	1	1	1	2	93	1,325	94	1,397

* Estimated.

PARCELS EXAMINED AND ACTION TAKEN.

Vessels Inspected		In Ballast	Lots Inspected	Seeds	Plants	Fruits and Vegetables	Total	Passed as free from Pests	Potatoes returned	Fruit returned	Fumigated	Destroyed	Dipped in	
Boarded	Bringing Vegetable Matter												Formalin	Bordeaux
Jan.	32	19	497	51	56	13,027	11,112	10,606	405	.....	5	96	.....	.....
Feb.	25	14	419	100	80	11,845	12,981	12,926	.....	.....	45	10	.....	.....
Mar.	38	22	410	151	44	7,897	8,428	8,379	13	.....	22	14	.....	1
Apr.	25	16	111	20	64	32,257	23,997	32,600	5	.....	110	15	1	2
May.	37	17	532	24	50	6,783	8,082	8,044	.....	.....	24	15	.....	2
June.	29	16	419	14	16	5,212	5,798	5,743	15	.....	33	7	.....	1
July.	31	16	1,004	9	9	10,664	10,532	10,320	.....	112	15	85	.....	.....
Aug.	28	21	677	7	4	12,487	13,802	13,732	.....	.....	6	61	.....	.....
Sept.	30	17	734	25	13	16,197	17,303	15,986	.....	230	1,068	19	.....	.....
Oct.	27	16	710	38	44	14,800	17,311	17,235	.....	.....	40	36	.....	.....
Nov.	30	17	877	25	48	15,051	16,666	16,738	.....	.....	16	12	.....	.....
Dec.	31	17	662	29	106	13,055	14,225	14,185	.....	.....	20	19	.....	.....
Total.	363	208	7,052	493	534	159,275	160,237	166,494	438	342	1,404	389	1	6
Average per month ...	30	17	588	41	44	13,273	13,353	13,874	36	29	117	32	.....	.....

It will readily be seen from the above tables that about a vessel a day was boarded by the Division officers and that about 50 per cent. contained some vegetable matter to be examined. On an average 588 lots and 13,353 parcels were inspected each month. At times, of course, we were greatly rushed with work owing to the arrival of several steamers at about the same hour, but through the kind coöperation of the U. S. Custom officers and the steamship agents, who did not allow anything to be delivered without our permission, we were able to accomplish our important work.

In the fifth report of the Entomologist attention was called to the enormous quantities of potatoes affected with Potato scab (*Oospora scabies*) and of the returning of some 2388 sacks to the Coast on account of this disease. I am pleased to say that this action had a marked influence on the potato shipper, for during the year but a few lots in comparison have been found sufficiently infested to cause a return shipment and some sorting of shipments was ordered done.

Generally speaking there is a very great improvement in the condition of all shipments of fruits, plants and vegetables, and there seems at present no reason why this condition should not continue in the future.

The greatest danger we have in the inspection is in the quantity of material arriving from the Orient, as most of the shipments consisting of various roots and bulbs are always mixed up in the general merchandise cargo and only by the thorough coöperation of the U. S. Custom officers and the ship brokers, and after days of patient waiting, can we attempt to start our thorough work. Much in the way of borers, fruit flies and fungus diseases has been found and rejected. Through the rigid ruling of prohibiting the shipments of fruit from the Orient and Pacific Islands we have been able to keep out many new pests and fungi among which were several scale insects, citrus white fly as well as on two occasions strong evidence of fruit boring insects. It would be impossible to destroy some of these pests by the usual methods of fumigation so that keeping out the fruit is by far the surest way of keeping out the many new pests. The greatest care is taken in watching importations of plants which constitute our larger industries here, sugar cane, pineapple, banana and mango. As on several occasions pests have been found which, if they should ever gain an entrance here, would in a measure repeat the great struggle and loss which was caused by the sugar cane leaf-hopper.

Cotton and Rice Industries.

During the last year much interest has been manifested in the growing of cotton and there is promise of further increase in the planting and experimenting of this profitable crop. We have

taken great precaution to prohibit the introduction of cotton seed from sections where the cottonboll weevil is known to exist, for should this pest, which now causes an annual loss of about \$25,000,000 in the United States, ever gain an entrance here, the new industry would soon go under. We have recommended, and wisely, that prospective cotton planters secure their seed through the Hawaii Experiment Station, who are in sincere coöperation with the Division of Entomology.

Vast experiments are now being carried on to improve the quality of rice grown in the Islands. Some of the best seed from Japan has been imported and after careful inspection and fumigation by this Division is now being planted in various sections. The rice weevil is a common pest with us and by careful inspection of rice shipments, further spreading of the pest will be avoided but there are other pests not known to exist here as yet, which cause great loss to rice culture in the Orient and close watch is being kept on all shipments liable to cause the introduction of these.

In safeguarding our Banana industry for instance from the Banana fruitfly which exists in Fiji I may mention that a shipment of bananas on deck of one of the Canadian-Australian steamers en route to Vancouver was covered over during the vessel's stay in port. This precaution will in a measure protect us from immediate danger and through friendly coöperation with the agents of the steamship company all such shipments will receive the same treatment hereafter.

The following is a list of all pests intercepted on shipments during the year:

INSECTS INTERCEPTED 1909.

Hemiptera-Heteroptera.

1. Capsid on Orchids, Manila.
2. Fulgorid on Orchids, Singapore.
3. Aradid on Orchids, Manila.
4. Chinch bug on Peaches, California.
5. Tingitid on Heteromeles, California.

Homoptera.

6. Hemichionaspis minor on Coconuts, Fanning.
7. Pseudococcus nipae on Palm, U. S. A.
8. Aspidiotus rapax on Plum, U. S. A.
9. A. cyanophylli on Palm, U. S.
10. A. sp. on Hilicornia metallica, Singapore.
11. Diaspis sp. on Orchids, Manila.

12. Diaspine on Carnations, U. S. A.
13. " " Dracena, Singapore.
14. " " Cactus, California.
15. " " Aloe, California.
16. " " Phalenopsis, Manila.
17. " " Dendrobium, Manila.
18. Parlatoria sp. on Citrus, Pa.
19. " on Weinia japonica, Japan.
20. Hemispherical scale on Orchids, Manila.
21. Pulvinaria on Azelea, Japan.
22. Ichnaspis on ornamental plant, Singapore.
23. Aulacaspis pentagona on Cherry trees, Japan.
24. Aleyrodes iridescens on Heteromeles, U. S.
25. " sp. on Clover, U. S. A.
26. Coccus hesperidum on Heteromeles, California.
27. Chrysomphalus bromeliae on Pineapples, Funchal.
28. Aphis on Carnation, U. S. A.
29. Pseudococcus citri on Smilax, Funchal.
30. P. longispinus on Smilax roots, Funchal.
31. Diaspis zamiae on Cycas, Manila.

Coleoptera.

1. Calandra oryzae on Ginseng, Hongkong.
2. Calandrid on Orchids, Manila.
3. " " " "
4. " " " "
5. Carabid on Peaches, San Francisco.
6. " " Fern, Japan.
7. " " Plants, Vancouver.
8. Ptinid. on Medicinal Herbs, Hongkong.
9. Lasioderma serricorne on Ginseng, Hongkong.
10. Tribolium ferrugineum on Orchids, Manila.
11. Calandra linearis on Yams, Hongkong.
12. Bruchus obtectus on Beans, Funchal.
13. B. chinensis on Peas, Japan.
14. Araecerus, 2 spp. on Palm seed, Sydney.
15. Necrobia rufipes on preserved meat, Hongkong.
16. Staphylinid on Orchids, Manila.
17. " " Garlic, Hongkong.
18. Elaterid on Orchids, Manila.
19. " " Fern, Japan.
20. Curculionid sp. on Orchids, Manila.
21. Sphenophorus sordidus on Banana roots, Fiji.
22. Hydrophilid 2 spp. on Iris roots, Japan.
23. Cerambycid borer on Rose roots, Japan.
24. Staphylinid on plants, Java.

25. *Carpophilus* sp. on Peach, San Francisco.
26. *Actheopeus aterrimus* on Orchids, Manila.
27. Cucujid on Yams, Hongkong.
28. Bostrichid in Rice, California.
29. Scolytid on Medicinal roots, Hongkong.

Diptera.

1. Syrphid on Rose, California.
2. Tachinid x Pupa of *P. rapae* on Cabbage, California.
3. *Phorbia brassica* on Turnips, California.

Euplexoptera.

1. Earwigs on Orchids, Manila.
2. Earwigs on Plants, Fiji.

Lepidoptera.

1. Leaf miner on Orange, Japan.
2. *Evergestis anastomosalis* on Yams, Hongkong.
3. Larvae on Rose plants, Japan.
4. Larvae on Peony plants, Japan.
5. Moth on Orchids, Manila.
6. Moth on Mango seed, Manila.
7. *Anarsia lineatella* on Peaches, California.
8. *Carpocapsa pomonella* on Apples, California.

Hymenoptera.

1. Ants on Fern, Sydney.
2. Ants on Orchid, Manila.
3. Ants on Orchid, Singapore.
4. Ants on Orchid, Manila.
5. Ants on Banana, Singapore.
6. Megachilid on Orchids, Manila.
7. *Monomorium vastator* in Soil, Sydney.
8. Ants on Bamboo, Japan.
9. *Andricus californicus* x Oak galls, California.

Orthoptera.

1. *Phyllodromia hieroglyphica* on Orchids, Manila.
2. *P. germanica* x Baggage, Hongkong.
3. Roach on Orchids, Manila.

Thysanoptera.

1. Thrips on Cocoanut, Fanning Is.

Thysanura.

1. Lepismid on Orchids, Manila.

Crustacea, Etc.

1. Spider on Orchids, Manila.
2. Pill bug on Orchids, Manila.
3. Pill bug in Soil, New Zealand.
4. Scorpion on Orchids, Manila.
5. Spider on Orchids, Manila.

The following table taken from our records shows the variety of fruits and vegetables imported into the Islands. Potatoes and onions are by far the largest articles in the vegetable line and oranges and apples lead in the fruit line. It is very evident that there is a chance for some home grown produce; especially potatoes and oranges to be used in our market instead of importing such large quantities as are listed below:

BOXES AND CRATES OF FRUITS AND VEGETABLES RECEIVED IN HONOLULU DURING 1909.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct	Nov.	Dec.
Apples.....	1,743	1,881	1,956	1,527	218	96	343	2,391	5,137	4,874	3,141	4,583
Apricots.....	...	...	...	...	...	206	207	34	...	6	11	...
Artichokes.....	4	20	14	33	23	5	1	2	1	2	19	15
Asparagus.....	...	10	22	74	46	31	31	15	2	...	5	2
Beans.....	201	3	...	...	...	...	...	21	...	50	133	...
Cabbage.....	33	37	...	...	...	4	85	41	254	132	175	100
Cantaloupes.....	2	...	...	...	...	...	30	32	...	6	...	...
Carrots.....	...	...	...	...	...	...	...	...	...	...	...	2
Cauliflower.....	61	68	74	80	52	104	108	109	125	87	134	105
Celery.....	29	55	29	23	...	...	15	15	37	42	83	73
Celery Root.....	1	3	1	...	...	...	...	...	...	...	1	2
Cherries.....	...	...	...	...	239	271	163	...	...	...	...	...
Coconuts.....	...	...	...	21,000	...	...	...	...	...	...	...	...
Cranberries.....	...	...	...	...	...	4	...	...	...	2	14	3
Figs.....	...	...	...	...	...	...	5	...	...	...	12	...
Fruit.....	11	5	...	...	...	...	23	24	50	6	9	28
Garlic.....	23	71	36	67	16	35	95	79	57	23	53	25
Grape Fruit.....	33	65	71	94	27	31	105	82	27	41	84	39
Grapes.....	...	...	...	...	...	...	89	441	978	842	1,021	3
Horse Radish.....	2	2	2	6	2	3	3	3	3	1	6	5
Lemons.....	38	247	194	319	87	261	230	278	294	247	318	277
Limes.....	...	...	...	...	...	...	...	...	...	...	...	...
Megs.....	...	...	...	...	...	2	90	60	86	47	47	...
Melons.....	...	...	...	...	...	...	23	1	2	4	...	1
Nectarines.....	...	...	...	...	...	...	35	95	...	...	...	...
Nuts.....	4	...	...	...	...	...	...	...	...	...	...	...
Onions.....	1,385	670	2,284	878	622	560	1,421	1,297	1,498	1,007	1,159	998
Oranges.....	2,491	1,585	1,272	3,100	2,842	2,561	1,758	2,135	1,185	1,610	1,922	2,053

BOXES AND CRATES OF FRUITS AND VEGETABLES RECEIVED IN HONOLULU DURING 1909—Continued.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Parsnips.....	11	3	...	...	...	...	...	1	...	...	6	6
Peas.....	2	...	15	20	25	19	33	14	1	...	...	...
Peaches.....	...	...	...	...	...	167	685	542	945	113	20	...
Pears.....	3	...	...	...	...	...	355	543	543	471	329	61
Persimmons.....	...	...	...	...	...	...	...	...	...	135	158	213
Plants.....	54	62	38	62	50	16	9	4	13	44	42	74
Plums.....	...	...	...	5	...	120	772	871	536	142	2	...
Prunes.....	...	...	15	...	...	7	5	19	44	17	39	...
Quinces.....	...	...	...	1	2	...	...	...	4	...	...	...
Rhubarb.....	5	9	17	38	16	7	11	...	...	...	...	3
Seeds.....	51	100	151	20	24	14	9	7	25	38	25	29
Sprouts.....	5	4	...	...	...	...	...	...	1	1	7	8
Spuds.....	6,437	6,529	1,699	4,622	2,518	663	3,938	3,337	4,365	4,872	5,913	3,682
Squash.....	...	3	...	...	...	1	2	...	1	...	3	3
Sweet Potatoes.....	...	...	...	1	...	...	...	1	1	...	...	...
Tangerines.....	483	573	196	363	42	50	...	...	...	...	148	711
Turnips.....	8	2	...	6	...	...	...	4	9	20	45	51
Trees.....	2	8	6	2	...	...	...	...	...	...	6	32
Vegetables.....	12	...	...	...	6	...	3	...	9	...	26	3
Yams.....	...	...	...	...	...	...	...	...	2	...	...	...
Total.....	13,134	12,015	8,092	32,341	6,857	5,242	10,982	12,498	16,235	14,882	15,124	13,190

As previously stated the work of rearing and distributing beneficial insects was somewhat hampered by the shortage of help, the office of Assistant Entomologist, who attended to this line of work, beside other duties, was not filled until October 1st and then only for a short period as a leave of absence was granted the Assistant on December 1st. The following list shows a record of such of the parasites and predaceous insects that were liberated during the year:

DISTRIBUTION OF BENEFICIAL INSECTS, 1909.

	Hawaii	Maui	Oahu	Kauai
<i>Coleophora inequalis</i> .....	..	..	..	1
<i>Cryptolaemus montrouzieri</i> .....	..	1	..	2
<i>Novius cardinalis</i> .....	..	1	1	..
<i>Hyperaspis jocosa</i>	2	..	16	..
<i>Scutellista cyanea</i>	1	..	..	..
<i>Rhizobius ventralis</i> .....	..	..	..	1
<i>Eucoila impatiens</i>	1	..	1	1
Japanese Beetle Fungus.....	1	..	9	2
	<hr/>	<hr/>	<hr/>	<hr/>
Totals by Islands.....	5	2	27	7

Total distributed 41

One colony of *Novius cardinalis* sent to Midway March, 1909.

One colony of *Platyomus lividigaster* and one colony of *Rhizobius ventralis* sent to Italy 1909.

INTRODUCTION OF SMYRNA FIG INSECT.

Through the courtesy of Mr. Walter T. Swingle in charge of Fig culture in the U. S. Department of Agriculture we were able to import on May 12th, a strong colony of Smyrna fig insects (*Blastophaga grossorum*). These were liberated in Moanalua gardens, where the only fruiting Capri or wild figs exist. About a month later while visiting the gardens we discovered the fig wasp in several Capri figs. It was about the end of September when again visiting the gardens that we discovered the good work of the fig wasp. On that occasion we found several perfect Smyrna figs, the first ever produced in the Islands and plenty of fig wasps issuing from the Capri figs.

I also submit herewith the report of the importation, breeding and distribution of the Hornfly parasite as furnished me by Mr. O. H. Swezey of the Hawaiian Sugar Planters' Association Experiment Station, who had sole charge of this work, receiving and distributing all parasites which have been sent by Mr. A. Koebele during the year.

PROFESSOR KOEBELE'S WORK ON THE HORN FLY FOR 1909.

*Report of O. H. Swezey, Hawaiian Sugar Planters' Association
Experiment Station.*

When Dr. Perkins left in May of 1908, on a year's leave, to me was assigned the care of the material which Prof. Koebele might send in the continuation of his endeavors to introduce parasites and predaceous insects for the horn fly. A great deal of material was received from him during the latter half of the year. In the main, the same method was employed in sending material as was used the previous season. Living specimens were packed in glass vials, enclosed in wooden mailing tubes and mailed to the Entomological Inspector of the California State Board of Horticulture at San Francisco, who kept them in cold storage till opportunity presented for forwarding to Honolulu by steamer, in which they were carried in cold storage. The length of time en route was usually a month or nearly so, owing to the fact that the shipments were often detained about a week in San Francisco awaiting a steamer. On account of such a long time on the way and the fact that very hot weather was encountered in crossing the continent, many of the shipments were almost a total loss, nearly every insect arriving dead. Later in the year, in the cooler months, more material survived the trip.

Below follows an enumeration of the different vials of material received, together with date of receipt, conditions, etc.:

Nos. 36-39, January, contained numerous dipterous puparia from which to breed parasites. Two male *Diapriids* bred from No. 36. Nothing more from any of them.

Nos. 40-45, April. Dipterous puparia, to breed parasites. No parasites ever emerged.

Nos. 46, 47, June 11. Dipterous puparia, to breed parasites. No parasites ever emerged.

No. 48, June 11. Two larvae of *Sphaeridium* (*scarabaeoides*). Both dead on arrival. This is a water beetle whose larvae feed on maggots in fresh cow dung.

No. 49, July 2. Large quantity of Dipterous puparia, to breed parasites. No parasites ever emerged.

Nos. 50-79, July 2. Larvae of *Sphaeridium*. These were mostly full-grown larvae placed singly in tubes with a little soil. Some matured and died before arrival; four adult beetles were still alive on arrival. Attempts to breed these were unsuccessful.

Nos. 80-101, July 16. Larvae of *Sphaeridium*, as in preceding. On arrival there was nothing alive. The beetles had mostly matured before dying.

Nos. 102-124, July 23. Larvae of *Sphaeridium*, as in preceding. All dead on arrival except one mature beetle. Most all of

the others had matured before dying. The one living beetle was in such a feeble condition that it did not live long.

Nos. 125-129, July 23. Larvae of a smaller species of *Sphaeridium*. All dead on arrival. They had matured before dying.

Nos. 130-141, August 25. Larvae and pupae of *Sphaeridium*. All dead on arrival. Most of them had matured before dying.

Nos. 142-145, August 25. Larvae and pupae of a Histerid beetle, singly in tubes. Two matured en route and were alive on arrival. Attempts at breeding them were unsuccessful. The larvae of this beetle are very voracious feeders on fly maggots in cow dung.

No. 146, October 2. Fourteen larvae of a small *Sphaeridium*, one adult; one pupa of a *Staphilinid* (*Philonthus aeneus*). All dead on arrival but 11 adult *Sphaeridium*. Attempts at breeding them were unsuccessful.

Nos. 147-149, October 15. Numerous Dipterous puparia, to breed parasites. On arrival there were 16 parasites that had emerged and died. There were 12 living parasites; and 20 more emerged October 19-21. These were bred on Dipterous puparia from cow dung. The first generation began to emerge November 8. This parasite is a *Cryptid* of the genus *Bathymetis*. In Germany this parasite attacks chiefly the puparia of *Siphona stimulans*, a near relative of our horn fly, but also other flies as well. Prof. Koebele considered this the most valuable of the parasites he was trying to introduce.

Nos. 150-154, October 28. Dipterous puparia in large numbers, to breed out parasites. On arrival there were 302 dead parasites (*Bathymetis*) having emerged from the puparia and died before arrival. One hundred twenty-three parasites emerged later and were retained for breeding.

Nos. 155-157, November 9. Large number of parasitized Dipterous puparia. Three hundred sixty-nine parasites (*Bathymetis*) had emerged and died before arrival. Twenty-three emerged (mostly males), only one or two at a time, between November 10 and December 27.

Nos. 158-163, November 6. Larvae of a small species of *Sphaeridium*, singly in tubes. All arrived dead but one which had matured.

No. 164, November 6. Pupa of *Philonthus aeneus* (?). It had matured and died before arrival.

Nos. 165-169, November 9. Large number of Dipterous puparia, to breed *Bathymetis*. A few had emerged and died before arrival. Thirty-nine emerged, a few at a time, between November 11 and November 26.

Nos. 170-173, November 24. Dipterous puparia to breed parasites (*Bathymetis*). Ninety had emerged and died before arrival,

and there were 56 alive. Sixty-eight more emerged between November 25 and December 23.

No. 174, November 26. Box containing adult beetles (*Aphodius fimetarius*). Ninety-two were alive; and there were about a dozen dead ones. These beetles burrow in cow dung, and their larvae feed in it. Their value lies in the fact that their burrowing through and through the cow dung makes it possible for parasites to enter more readily to attack the fly maggots and puparia therein; it also allows the dung to dry up more readily and therefore be less favorable for horn flies to breed in. The most of these beetles were liberated on one of the ranches. A few were retained to attempt breeding them, but without success, no doubt due to its being the season of the year in which they are accustomed to hibernate.

No. 175, November 26. Parasitized Dipterous puparia. One *Cryptid* (*Atractodes* sp., Koebele's No. 2656) had emerged and died; one was living, but soon died. Three males emerged December 9.

No. 176, November 26. Parasitized Dipterous puparia. The parasites (*Atractodes* and an *Alysiid*) were seen ovipositing in the young maggots. Nothing had emerged before arrival. One female and one male *Atractodes* emerged December 2. Four males and three females of the *Alysiid* emerged between December 9 and February 9. They were so scattered that only once did I have both sexes living at the same time. An attempt at breeding them on maggots was unsuccessful. With the pair of *Atractodes* I did succeed in breeding one generation, but so few emerged, and they were not simultaneous, so that I was unable to breed them further. Two female *Cynipids* also emerged from this tube, February 25.

Nos. 177-179, November 26. Parasitized Dipterous puparia. Sixty males and 30 females of *Bathymetis* emerged between November 30 and December 23. These were mostly liberated with others that I had bred.

Nos. 180-182, December 11. Parasitized Dipterous puparia. No. 180 was lost in the mails. Nothing bred out of No. 182. From No. 181 quite a number of *Bathymetis* had emerged and died before arrival; three females and 5 males emerged between December 31 and April 4, 1910.

Nos. 183-195, December 11. *Philonthus aeneus*, mostly one or two per tube, either larvae, pupae, or adults. Nos. 191-192 were lost in the mails. Two adult beetles and one larva were alive; others all dead. Unsuccessful in breeding these.

Nos. 196-197, December 11. Two larvae of another species of *Philonthus*. One arrived alive, and matured later.

No. 198, December 17. *Hister bimaculatus*. Nine living adult beetles.

No. 199, December 17. A small black Histerid. Five living adult beetles.

No. 200, December 17. *Hister unicolor*, a large black Histerid. Two living adult beetles. All these Histerids (Nos. 198-200) were retained to breed; but failing to do so (owing perhaps to its being their hibernating season) they were eventually liberated on a cattle ranch.

No. 201, December 17. *Coccinellids*. All arrived alive; about two dozen, mostly *Adalia bipunctata* and *Coccinella septempunctata*. These were liberated on orange aphids.

No. 202, December 17. Parasitized Dipterous puparia. No parasites bred out.

No. 203, January 7, 1910. *Aphodius fimetarius*. Out of about three dozen adult beetles, but 7 arrived alive. They were liberated on a ranch.

No. 204, January 7. A dung beetle, *Onthophagus nuchicornis*. Of about a dozen, only three were alive on arrival. Attempts to breed them were unsuccessful.

No. 205, January 7. Six adult *Staphylinids* of a small species; seven small *Hydrophilids* of two different species. These were all liberated in a dairy pasture.

Nos. 206-209, January 7. Parasitized Dipterous puparia. From 206 one male *Alysiid* emerged February 8. Nos. 207 and 208 had a few living *Bathymetis* on arrival; in No. 209 were about two dozen dead ones. From Nos. 207-209 about two dozen *Bathymetis* emerged between January 7 and March 31.

Nos. 210-211, January 7. Parasitized *Coccids*. Cared for by Mr. Ehrhorn.

No. 212, January 7. Dipterous puparia parasitized by *Atractodes*. None ever emerged.

No. 213, January 7. Parasitized Dipterous puparia. No parasites emerged except two *Spalangia* in February.

No. 214, January 7. Nine small *Staphylinids*; one larger *Staphylinid*; three small black *Hydrophilids*. All were liberated in a dairy pasture.

From the above it will be seen that the *Cryptid* (*Bathymetis* sp.) is the only one of the parasites that I was able to breed successfully. Several colonies of this parasite were liberated in dairies of Oahu, and a few ranches on the other islands, during November to January; so that they have had a chance in various sorts of situations, and it is to be hoped that they have become established in some of them. These colonies were made up of parasites reared in breeding jars in the insectary, together with others that emerged from material received from Prof. Koebele from time to time.

Unfortunately just when these parasites were nicely started breeding in the insectary the winter season came on, and although

the temperature was not much reduced, yet the parasites mostly went into a hibernating condition. Instead of maturing in three to four weeks from the egg as they had been doing normally, the larvae would get their full-growth in the puparium of the host, spin a cocoon therein, then lie dormant in the larval stage for several months, some going thus from December till the following May before maturing. Thus hibernating during the season they were accustomed to in their native home, even though not subjected to the lower temperatures of that place. This put a stop to the distribution of colonies for the time; but at the present time (May) they are breeding again more rapidly, so that no doubt during the coming summer, colonies will be obtained for distribution to the various ranch districts not previously supplied.

Another feature which has made it slower breeding up colonies for distribution, is that the males are far in excess of the females, often at the rate of ten to one. In one case, where fifty parasites emerged from one breeding jar, all were males,—a worthless colony.

This parasite attacks the host after the puparium has been formed. The maggot of horn fly and other flies breeding in cow dung, when they become full-grown, form their dark reddish puparia in or beneath the cow dung and even in the soil below. The female parasites crawl about in the dung in search of these, piercing and putting a single egg in each. This soon hatches and the parasite larva consumes the fly larva or pupa inside, becoming full-grown in about two weeks. It then spins a whitish cocoon inside and in contact with the wall of the puparium, in which the pupa stage is passed through in a week or a little more. The adult parasite emerges by gnawing a roundish hole on one side near one end of the puparium. The normal period from oviposition to the emergence of the adult parasite, is three weeks when breeding in horn fly, and a little longer when breeding in the puparia of larger flies. The parasite is somewhat undersized also when breeding in horn fly puparia. They apparently breed in whatever puparia they find regardless of species.

Prof. Koebele considers this parasite a highly valuable one in Europe where it specially breeds on a near relative of our horn fly. It will no doubt be a helpful check on the horn fly here if it succeeds in becoming established.

Another important step for the furtherance of beneficial insect work was made by appointing Mr. Fred Muir, who is on the entomological staff of the Hawaiian Sugar Planters' Association, Beneficial Insect Collector of this Board, so as to give his work abroad official standing. Mr. Muir is engaged in the search of parasites for the sugar cane borer, one of the very destructive pests of the cane industry. Being connected with the Board through this appointment Mr. Muir is also looking out for parasites for the Alligator Pear scale, *Pseudococcus nipae* and the

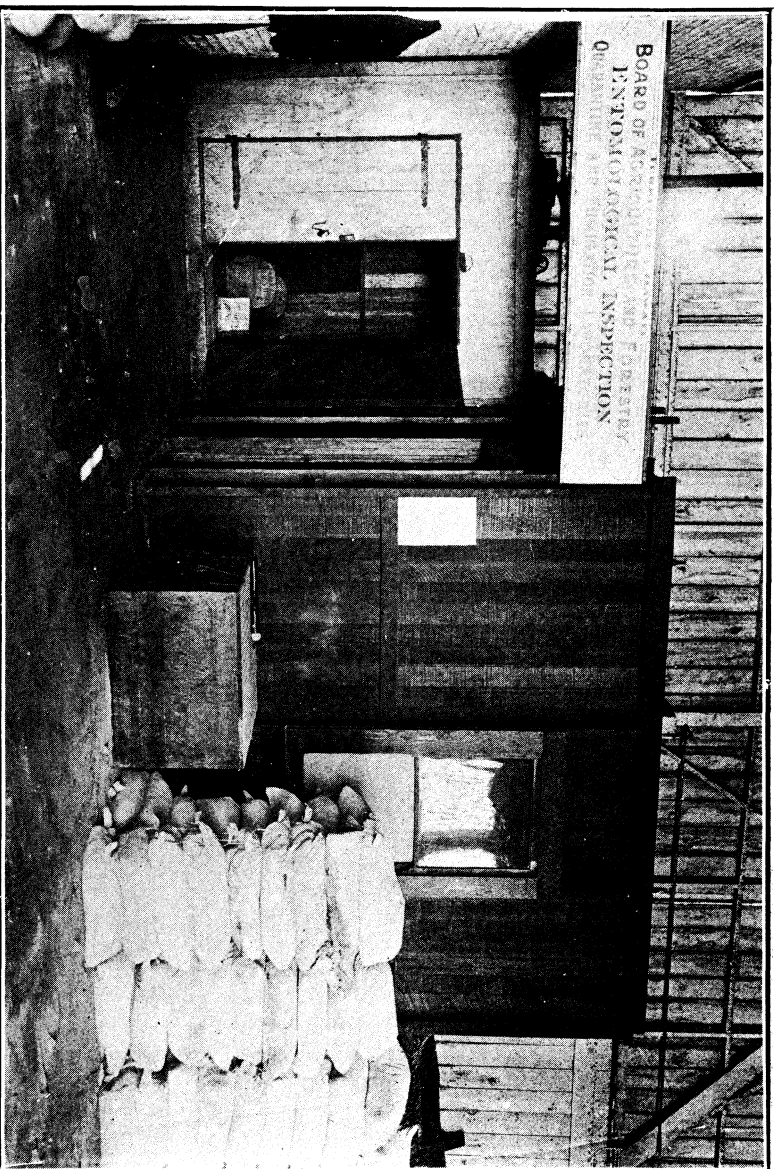


Plate 23. Laboratory and Fumigatory on Oceanic Wharf.

Melon maggot, *Dacus cucurbitae*. Every effort is being made to find these parasites and it is hoped that during 1910 we may be able to succeed in finding such that will in a measure give us relief. The parasites which were kindly sent here by Mr. George Compere did not take hold of the Melon maggot although every chance was given them. Being the parasite of the Orange fruit-fly there was great doubt of the work in the beginning, but we must endeavor to test every opportunity in this great work.

PINEAPPLE SCALE.

Our pineapple growers have experienced quite an additional expense at the shipping points on the Coast, by being compelled to re-fumigate all pineapples found infested with live Mealy bugs. All inspection work along the Pacific Coast has become very stringent and all fruits and vegetables found infested are either condemned or fumigated according to the pest found, we can hardly blame the Coast people for this action. Some seemed to think that it was an indirect boycott on the pineapple business, but I can positively say that no such feeling exists. We might as well expect the potato shippers to say that when we condemned scabby potatoes we did it to boycott potatoes.

There is no need for the pineapple growers to have this trouble and expense if they will only practice clean culture. If all suckers to be used for new plantings are first subjected to a good fumigation before planting and if all old plants, now allowed to remain piled up adjacent to the pineapple fields, where they remain breeding thousands of Mealy bugs, would be carted away to some vacant field and destroyed by fire as soon as possible, much would be accomplished in the way of reducing the pest and by carefully fumigating all pineapples before packing for the Coast shipment very little trouble will be experienced in the future. I find that the fumigating methods generally practiced by the pineapple grower were faulty and since advising with them and prescribing the right dosage to use, better results have been obtained.

RECOMMENDATIONS.

In the report of the Entomologist for 1908, on page 112, reference is made to Inter-Island inspection. Inter-Island inspection can be compared to Inter-County inspection of other States and we know that a great deal of good has been done, by preventing certain insect pests and plant diseases from being transported into new districts by the good laws and ordinances adopted by the various counties. The time is at hand when such steps should be taken to prevent the dissemination of pests known to exist on some of the Islands from being sent to the other islands

not having these. Now that there is a movement on foot to establish other agricultural industries on a larger scale I would recommend that the Board of Agriculture and Forestry look into the possibility of establishing Inter-Island inspection and if need be take such action with the County authorities of the various islands so as to be in coöperation with this Division. We must endeavor to protect the present as well as the future agriculturist and much labor and money can be saved by starting while the industries are not very extensive.

Assistant Entomologist.

Since June, 1908, the office of Assistant Entomologist has, practically speaking, been vacant and much work which should be done by such office has been left undone. It is to be hoped that the Board of Agriculture and Forestry can see its way clear to furnish this Division with a competent assistant. All the work of rearing parasites and other important studies on the life history of our various pests can be accomplished by a good assistant, I therefore recommend that you give this your earnest thought.

Serious Pests.

Of the few remaining pests of the agriculturist, the Melon fly, *Dacus cucurbitae*, the Alligator Pear Scale, *Pseudococcus nipae* and the Japanese Beetle, *Adoretus tenuimaculatus*, continue to give much trouble and great loss. It shall be our aim during 1910 to endeavor to introduce parasites for the Melon fly and Alligator Pear Scale, this, of course, depending on the amount of money available and the much needed help of an Assistant Entomologist. We have recommended remedial measures for both pests and have obtained some success. Scale on young trees has been successfully sprayed, but as long as the larger trees, which are out of the question of spraying, furnish continual broods of scale, we shall not be able to accomplish much with spray. We know of the existence of parasites in the West Indies, Mexico and the Philippines, and steps have already been taken by correspondence, to ascertain the extent of the pest in these countries. Clean culture to cope with the work of the Melon fly has been recommended with good results and wherever the affected melons, cucumbers and squash have been destroyed and with these the millions of larvae of the fly, a great reduction of the pest has been noted, but not all growers take such steps and they produce enough flies to furnish the industrious grower with new broods. A good efficient parasite must be obtained and through correspondence we have endeavored to coöperate with other countries where the fly is not a serious pest. Owing to the life of the fly, it will be a very difficult undertaking to import the parasite and

it probably will be necessary to send some one to collect the parasite and care for these on the return voyage, however, this will be a matter for future consideration. In this connection while searching for this parasite it would be very important to ascertain the reason why the Japanese Beetle is not reported as a pest in Japan.

Respectfully submitted,

EDW. M. EHRHORN,
Superintendent of Entomology.

The preceding Report being a compilation of the work performed by the former Superintendent of Entomology, Mr. Jacob Kotinsky, it was deemed advisable to keep his report and that of the present Superintendent separate.

Report of Superintendent of Entomology for 1910.

Honolulu, Hawaii, December 31, 1910.

Honorable Board of Commissioners of Agriculture
and Forestry of the Territory of Hawaii.

Gentlemen:—I have the honor to submit herewith the seventh report of the Division of Entomology, covering the work of this division for the calendar year 1910.

The work performed by us during the above period consisted chiefly in the quarantine inspection of agricultural and horticultural products, arriving in the Islands by steamers and sailing vessels, being found in the large freight shipments, passengers' baggage, express packages and the mail. We have boarded 459 steamers and sailing vessels, from which were discharged and inspected 210,058 packages of fruits, vegetables and plants. Of these we destroyed 427 packages, which were either infested with injurious insects or plant diseases, or were prohibited from entering the Territory under existing rules and regulations pertaining to fruit and plant shipments from certain countries.

The value and importance of this work has been clearly demonstrated in the past, and from the following report it will be seen that with the growth of population and commerce, our work naturally is continually increasing.

STAFF.

Superintendent of Entomology.

Your Superintendent has continued as head of the division during the year without the aid of an assistant entomologist up to July 1st, when the Board appointed Mr. H. O. Marsh on my recommendation. Very little laboratory work and breeding of parasites was done during the time previous to his appointment on account of the lack of help, most of the time being taken up by the inspection of plant and fruit shipments which required nearly all of our attention, and only during very short periods was it at all feasible for us to attend to the distribution of parasites and to the investigation of some field pests which caused injury.

Consulting Entomologist.

Mr. Albert Koebele, the Consulting Entomologist, has continued his search for parasites of the Hornfly, he being absent

during the whole year in Europe. He has sent a number of parasites and dung beetles, which were turned over to the entomologist of the Hawaiian Sugar Planters' Experiment Station, and after careful breeding many colonies have been liberated on several stock ranches of the Islands. The appended report of Dr. Perkins summarizes the results of the importations of Hornfly parasites.

Assistant Entomologist.

As stated above, this position has only been filled during the last six months of this year, and Mr. Marsh has undertaken a series of field experiments, particularly on pests attacking truck crops, which are now becoming more extensively cultivated. By his careful work and practical demonstrations he has been able to induce a number of growers to take up practical spray work. They have purchased the necessary apparatus and now use remedies which have been thoroughly tested by the Division.

The small and rather inadequate insectary on the grounds of the Board has been temporarily fitted up inside to suit the requirements for insect breeding, and despite this fact I am pleased to say that Mr. Marsh has been able to do some excellent work on the life history of a few of the more serious truck pests. A larger and more complete insectary is absolutely necessary to carry on the work on more extensive lines. There are, of course, pests of some of the field crops which cannot be combated by applied remedies on account of the impracticability of such an undertaking. This was demonstrated on an acre of Broom-corn this season. Efficient parasites in such cases are the only true relief; whenever we are able to procure such. Clean culture also has a very direct bearing on all such work.

Mr. Marsh's report follows as an appendix hereto.

Inspectors.

Mr. D. B. Kuhns has continued as inspector of fruits and plants and has given very satisfactory service. Owing to the arrival of vessels at all hours, our time is not regulated by any laid-down rule, but whenever necessary we are ready for duty in the early morning hours or late at night, including many Sundays and holidays. Owing to the rapid increase of shipping and of the larger consignments received here for the ever-growing population, it will be very necessary to make provision for an assistant inspector. The possibility of too much inspection work for the present force is bound to weaken the efficiency of it, not by wanton neglect, for such does not exist, but by an over-tax of labor.

For the first half of this year the Division did have an assistant inspector, Mr. L. V. Lewis, who served until August 1, 1910, but on account of the shortage of funds which were required for the salary of the assistant entomologist, his position had to be abandoned. I cannot emphasize too strongly the necessity for providing an extra amount for the office of assistant inspector.

Our regular inspector at the Port of Hilo, Brother M. Newell, is still retained and has faithfully performed his duties, which, on account of the increase of imports, have at times been rather strenuous. Here also we shall have to make provisions in the near future if we are to keep up the good work of the past; no provision is made in case of sickness, at which time there would be no one to look after the work. If provision could be made for an assistant at Hilo who could at the same time act as Collaborator in the Forest Nursery, which is under Brother Newell's charge, I believe it would do much to obviate any possible calamity

Honorary Inspectors.

The following gentlemen are still acting as honorary inspectors: Robert E. Elgin, Mahukona, Hawaii; W. O. Aiken, Kahului, Maui; W. D. McBryde, Koloa, Kauai, and Dr. W. D. Deas, Hana, Maui. These gentlemen have not been called upon for active service, but are ever ready to give assistance should an occasion offer itself.

During the last year Miss Melika Peterson has acted as stenographer for the Divisions of Entomology and Animal Industry combined, and under these circumstances has done the work very well, but it would be of greater advantage to have each Division furnished with its own stenographer, as many smaller details are often put aside pending the work of the other Division, which are hard to pick up again later on.

Lines of Work.

In the report of 1909, it was hoped to do much in the way of breeding beneficial insects, combating pests, and continuing the expansion of the insect collection. However, owing to the shortage of funds and the vacancy of the office of Assistant Entomologist for six months, we were unable to take up much of this work during that period, as nearly the whole of our time required our attention at the steamship docks, inspecting the enormous shipments of fruits, vegetables and plants arriving every few days. The accompanying tables give a summary of the inspection work performed by us at Honolulu and Hilo:

HONOLULU INSPECTION.

MONTH.	Vessels Inspected...	Vessels Carrying Vegetable Matter.	PASSED		FUMIGATED		BURNED		RETURNED		Seeds.....	Plants.....	Fruits and Vegetables.....	TOTAL INSPECTED	
			Lots	Parcels	Lots	Parcels	Lots	Parcels	Lots	Parcels				Lots	Parcels
Jan.....	34	18	884	22,568	31	39	21	102	..	..	101	75	22,533	936	22,709
Feb.....	25	18	480	11,155	20	49	5	11	..	..	148	85	10,982	505	11,215
March...	27	18	449	9,750	14	31	5	5	..	..	138	99	9,549	468	9,786
April....	33	21	700	15,345	23	30	37	37	1	1	126	99	15,188	762	15,413
May.....	33	20	511	9,942	7	7	39	64	..	..	115	99	9,799	557	10,013
June....	32	19	915	14,328	8	16	11	11	..	..	57	57	14,241	934	14,355
July.....	29	17	781	14,594	7	19	4	6	..	..	72	60	14,487	792	14,619
Aug.....	32	19	1,134	16,069	8	61	6	12	..	..	165	53	15,924	1,148	16,142
Sept.....	34	13	1,082	15,038	6	33	13	13	1	15	57	161	14,881	1,102	15,099
Oct.....	29	17	1,408	22,609	10	28	24	31	..	..	76	165	22,427	1,442	22,668
Nov.....	30	19	1,206	16,416	23	98	2	23	1	9	95	143	16,308	1,242	16,546
Dec.....	32	19	882	20,165	10	309	54	54	..	..	185	378	19,965	946	20,528
Total....	370	218	10,432	187,979	167	720	221	369	3	25	1,335	1,474	186,284	10,834	189,093

HILO INSPECTION.

MONTHS.	Vessels Inspected	Vessels carrying vegetable matter	Passed free from pests	Treated before releasing	Burned	Returned	TOTAL	
							Lots	Packages
January.....	7	3	1744	75	..	..	105	1,819
February.....	6	2	1626	25	..	..	101	1,651
March.....	6	2	1523	..	..	..	94	1,523
April.....	10	4	1464	..	1	..	87	1,465
May.....	6	3	1105	29	..	..	72	1,134
June.....	7	3	1080	..	..	..	105	1,080
July.....	7	3	1194	..	..	..	107	1,194
August.....	15	2	2240	..	..	2	127	2,242
September.....	9	2	1738	..	..	..	96	1,738
October.....	6	4	1663	25	..	..	104	1,688
November.....	4	2	1617	35	6	30	109	1,688
December.....	6	3	3743	..	..	..	182	3,743
Total.....	89	33	20,737	189	7	32	1,289	20,965

BOXES AND CRATES OF FRUITS AND VEGETABLES RECEIVED IN HONOLULU DURING 1910.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples.....	4,721	1,000	1,549	2,440	1,100	410	813	3,090	4,491	7,771	5,518	5,374	38,277
Apricots.....	10	...	...	...	...	529	229	5	10	1	2	...	786
Artichokes....	19	19	...	30	22	8	1	1	3	20	8	...	148
Asparagus....	2	1	21	68	64	29	12	...	3	...	...	...	200
Beans.....	45	4	...	40	...	2	2	...	1	507	18	32	653
Cabbage.....	244	42	12	78	...	43	40	186	181	237	281	185	1,529
Carrots.....	2	3	...	5	...	...	...	7	17	15	25	59	133
Cauliflower....	152	117	98	92	91	146	114	142	104	142	292	200	1,690
Celery.....	52	76	53	73	12	21	60	222	97	112	173	189	1,140
Celeryroot.....	3	1	1	3	...	...	2	...	...	3	4	4	21
Cherries.....	...	...	...	...	304	1,312	86	...	...	...	...	...	1,702
Cranberries....	...	...	...	...	...	...	...	...	...	...	13	8	26
Figs.....	4	...	1	1	...	1	2	2	...	3	4	4	22
Fruit.....	4	...	8	3	2	29	26	42	50	14	53	21	259
Garlic.....	77	43	74	36	26	70	100	133	29	38	54	22	702
Grapefruit....	81	37	61	111	48	124	31	55	58	94	88	143	931
Grapes.....	...	...	...	...	3	...	49	694	1,531	1,927	1,023	219	5,446
Horseradish...	5	4	2	6	5	4	3	5	1	4	10	12	61
Lemons.....	299	95	151	410	292	376	245	221	375	443	168	364	3,439
Limes.....	...	...	...	...	...	...	...	...	132	1	...	...	1
Megs.....	7	4	...	...	...	96	131	206	...	127	54	...	762
Nectarines....	...	...	...	...	...	...	20	78	...	...	...	...	98
Nuts.....	7	2	...	2	2	...	...	2	2	16	4	3	40
Onions.....	1,406	1,865	1,399	1,389	524	1,404	1,714	1,878	583	1,484	1,474	1,287	16,407
Oranges.....	4,280	1,332	1,740	3,512	1,733	3,121	1,812	999	1,142	854	1,250	4,554	26,319
Parasnips....	13	9	4	9	9	9	6	10	19	13	7	16	124
Peas.....	...	2	...	14	21	23	...	3	1	7	29	29	129
Peaches.....	...	...	...	...	...	672	1,049	1,130	1,010	1,558	...	...	5,419
Peanuts.....	...	...	...	...	...	1	4	...	...	...	...	...	5
Pears.....	80	3	...	3	10	55	720	611	672	420	203	34	2,811

FRUITS, PLANTS AND VEGETABLES INSPECTED IN ORIENTAL CARGOES, 1910.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
* Apples.....	...	...	2	8	6	1	...	...	...	3	11	3
Asparagus.....	...	1	...	...	...	...	...	...	5	...	...	1
Chestnuts.....	66	17	7	...	...	...	...	...	...	...	...	40
Chestnuts (Water).....	109	51	38	31	36	57	51	60	28	40	10	88
Caladiums.....	153	84	60	6	...	...	1	...	...	...	62	...
* Fruit.....	10	...	...	...	...	2	...	6	...	...	4	2
Garlic.....	...	...	4	3	6	10	1	...	...	...	...	...
* Grapefruit.....	5	4	...	4	9	3	...	...	...	...	...	...
Ginger.....	60	11	15	7	10	27	7	13	13	32	35	40
Horse Radish.....	...	1	1	...	...	...	2	...	...	1	...	...
* Lemons.....	...	...	...	...	...	2	...	...	...	...	...	3
Lily Bulbs.....	49	120	12	...	...	1	...	...	1	38	46	49
Medicinal Herbs.....	38	...	26	18	18	52	18	14	...	20	...	...
Nuts.....	16	7	2	1	...	...	5	...	...	4	...	11
Onions.....	9	...	...	...	...	...	...	...	...	...	...	...
* Oranges.....	...	2	4	6	11	3	3	2	...	...	1	7
* Peaches.....	...	...	...	...	...	...	...	...	...	...	...	...
Peanuts.....	...	...	...	...	...	...	...	...	...	...	1	...
* Pears, Sand.....	5	1	5	...	12	...	...	3	7	17	2	9
* Persimmons.....	...	...	...	...	...	...	...	...	...	...	...	2
Plants.....	2	5	7	4	28	5	17	25	39	37	86	311
* Pomelo.....	4	...	3	7	...	...	...	...	...	2	...	5
Seeds.....	34	33	50	28	44	27	17	40	30	18	50	61
Sweet Potatoes.....	10	...	3	2	5	9	10	22	12	6	3	19
* Tangerines.....	18	3	4	2	...	3	...	...	...	...	31	23
Trees.....	42	3	...	4	...	...	2	...	...	...	...	6
Vegetables.....	3	7	4	1	11	...	2	...	3	1	1	5
Yams.....	5	2	1	9	8	13	2	14	9	38	68	86
Total.....	638	352	248	141	204	215	138	199	147	258	411	771

Grand Total, 3,722.

* Prohibited by law.

From the preceding tables it will be seen that there is a decided increase in all shipments of fruits and vegetables arriving in the Islands, a fraction over 18½% on all packages, which is caused by an increase of about 43½% on the various lots received. We beg to acknowledge the great aid we received from the members of the U. S. Customs Service and the various steamship companies while handling these enormous shipments.

The real difficulty which we continue to encounter in our inspection work is found in oriental cargoes. Here much of the fruits and vegetables are included as general merchandise and only after patient waiting and thoroughly segregating the invoices are we able to locate such shipments. As a great deal of dangerous material is found in these shipments, such as diseased yams, potatoes, bulbs and fruits, which diseases are liable to attack cane and taro, the importance of a very careful inspection will be readily understood. All shipments are closely watched by a member of the Division until released by the Custom House, then we can undertake our inspection, and as this work employs a man from a few days to sometimes one week, it will be apparent that the plea for an assistant inspector for dock work is not an unjust demand.

Improvement of Shipments.

I am pleased to be able to report that at Honolulu, as well as at Hilo, the improvement on all shipments of fruits and vegetables is very marked. This has been caused mainly by a plea from the Division to all consignees and a demand to all Coast shippers of these articles. Not only has this resulted in cleaner shipments, but the quality of the same has greatly improved. Whenever shipments are found not to be up to the requirements, they have been returned to the shippers. All consignees are only too glad to coöperate with the Division, as they find that it is a great benefit to their business.

Inspection at the U. S. Postoffice.

Through the kind coöperation of the postoffice authorities at Honolulu and Hilo, we are able to inspect the enormous consignments of packages containing seeds and plants and occasionally fruit which arrive at these places. Our equipment at the postoffice consists of a small fumigating box and all plants and seed requiring fumigation are handled here without much delay. At Hilo we are equipped in the same manner, and we may safely say that very little escapes inspection by this system.

During this year the Division of Forestry has received large quantities of seeds for the propagation of trees for forest planting.

These consignments have passed through our hands for inspection, and we have fumigated the bulk with Carbon-bisulphide more as a precaution against the possible introduction of seed enemies. During past years there has been quite a loss in the stored seed of the Division of Forestry. The seed, which is gathered in season by the seed boys, has usually been attacked by several weevils, and after storage of a few months becomes worthless. It is gratifying to know that my Division has been able to assist the Forester in checking this loss, which means quite a saving to his department and a gain in the propagation of nursery stock.

The Division has had frequent applications from parties for the fumigation of plants and seeds for outward shipments abroad. We have considered this a good feature, and have gladly done what we could, as we deem it very important to aid in the check of distribution of pests to other sections.

Additional Equipment and Improvements.

What may be considered a good step towards improvement in the service, is an additional office laboratory and fumigatory, located on the Alakea Dock, which the Division was able to procure rent free from Hon. Marston Campbell, Superintendent of Public Works. It has been a great task, and some delay in the past to haul plant and fruit shipments from the above dock to the laboratory located on the Oceanic Dock, but by this acquisition all delay is obviated and the great risk of hauling infested goods over the streets has ceased. We now have moved the fumigatory which stood on the Channel Dock, this dock not being much used, to the Alakea Dock. It is equipped with a four-inch pipe with gate valve as an exhaust for the gas, giving us a splendid facility for our work. The exhaust pipe on the fumigatory on the Oceanic Dock has also been overhauled, so that more draft and a better exhaust of the dangerous gases can be had. In addition two small fumigating boxes have also been built for the handling of small packages, which are often found among the passenger's baggage. We shall save a great deal of expense by the use of these, as they do not require such a large quantity of chemicals for the preparation of the gas, which is required to fill the large fumigatories. As soon as the Hackfeld Dock is finished we shall overhaul the large fumigatory located on it and add to the equipment a tight workroom for inspection work. This dock will be used by the Matson Steam Navigation Company, whose vessels bring enormous shipments of fruits and vegetables, and we shall be well equipped to handle all incoming materials without much delay. The three fumigatories being on the most im-

portant docks, are so situated that should any shipment arrive on any adjacent dock it can easily be transferred to either of these, which, however, is only expected to happen at rare intervals.

The following is a list of all pests and diseases found on shipments during 1910:

INJURIOUS INSECTS AND DISEASES INTERCEPTED WHICH WERE FOUND ON SHIPMENTS OF FRUITS, VEGETABLES AND PLANTS DURING THE YEAR 1910.

Coleoptera.

Sphenophorus sordidus, Schop. Banana roots from Fiji.
Scarabacid larvae, in soil about roots from Japan.
Tenebrio molitor and larvae in package from U. S. A.
Anthribid weevils in seeds from Jamaica.
Cylas formicarius, Fab., in sweet potatoes from Japan.
Actheopeus aterrimus, Waterhouse, on orchids from Manila.
Curculionid larvae in chestnuts and acorns from Japan.
 Two species of *Curculionids* in orchids from Manila.
 Two species of *Hydrophilids* in orchids from Manila.
Nitidulid in orchids from Manila.

Lepidoptera.

Tortricid leaf roller in rose plants from Japan.
Nephroterys rubrizonella? in sand pears from Japan.
Tineid larvae in ferns from New Zealand.
Sanninoidea extiosa in peach roots from Florida.
Thyriodopteryx sp. (?) Bag worm on Camellia from Japan.
 Codling moth larvae in fruit from U. S. A.

Hemiptera.

Capsid in onions from Japan.
Triphleps sp. in plants from U. S. A.
Fulgorid leaf hoppers in plants from U. S. A.
Aradid (bark bug) in orchids from Manila.

Hemiptera homoptera.

Two species *Aphis* on rose plants from Japan.
 Raspberry *Aphis* on Raspberry plants from U. S.

Hymenoptera.

Monomorium vastator, L., in package from U. S.
Pheidole javana, Mayr., in orchids from Manila.

Coccidae.

Aulacaspis rosae, on rose plants from Japan.
Aspidiotus rapax, on plants from U. S.
Aspidiotus cyanophylli, on palms from U. S.
Pseudococcus citri, on plants from Fiji.
Diaspis zamiae, on Cycas from Japan.
Lepidosaphes beckii, on peach trees from Florida.
Coccus depressus, on palms from U. S.
Ceroplastes rusci, L., on tea plants from Japan.
Aulacaspis pentagona, Targ., on cherry trees from Japan.
Pseudaulonidia duplex, Cock., on plants from Japan.

Thysanoptera.

Thrips on orange trees from Hongkong.

Miscellaneous.

Mites on pine trees from Japan.
Nemalodes, *Heterodera radicola*, on potatoes from U. S. A.
 Red spider on plants from U. S. A.
 Scorpion, centipedes, 5 species of spider, and several species
 of pill bugs, *Oniscidae*, in orchids from Manila.
 Large slug, *Veronacella* sp., on plants from Manila and Fiji.

Diseases Intercepted.

"Fiji cane disease," on sugar cane found in possession of
 passenger.

Cladosporium citri, on citrus fruits and plants from Orient.

Spot disease on apples from Japan, resembling bitter rot.

Pear scab, on pears from United States.

Potato scab, *Oospora scabies*, on potatoes from United States.

Sugar Cane Infested.

During the year three lots of sugar cane from Fiji and the
 Orient were found in the baggage of passengers and immigrants.
 In one case we found the dreaded Fiji cane disease. The risk
 of having such material enter the Territory is too well known to
 us, and we are constantly on the lookout for it. All sugar cane

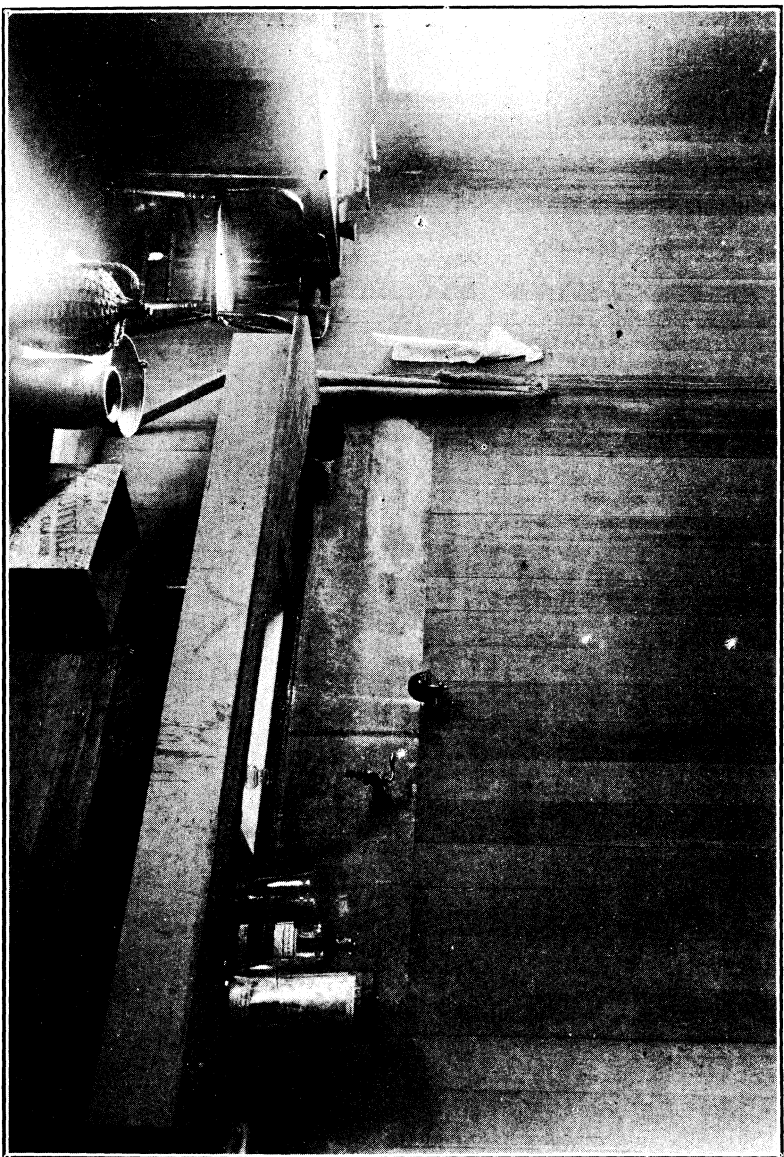


Plate 24. Interior of Laboratory on Oceanic Wharf.

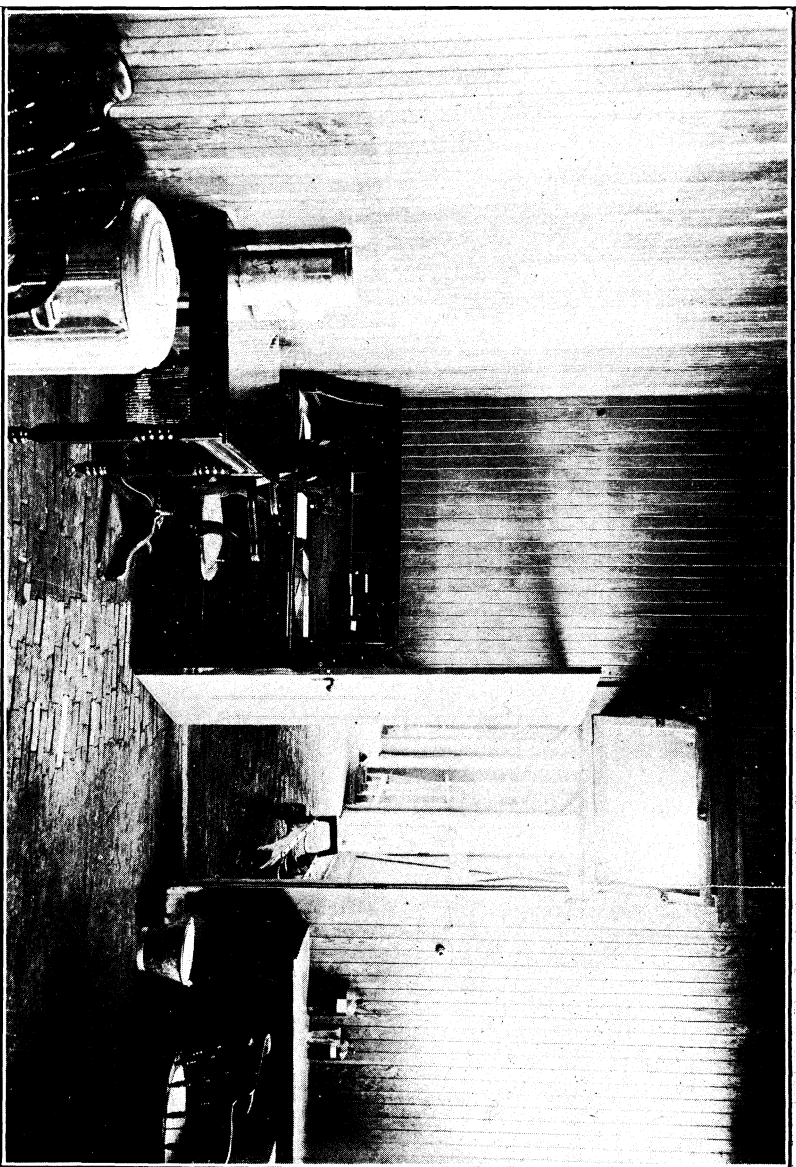
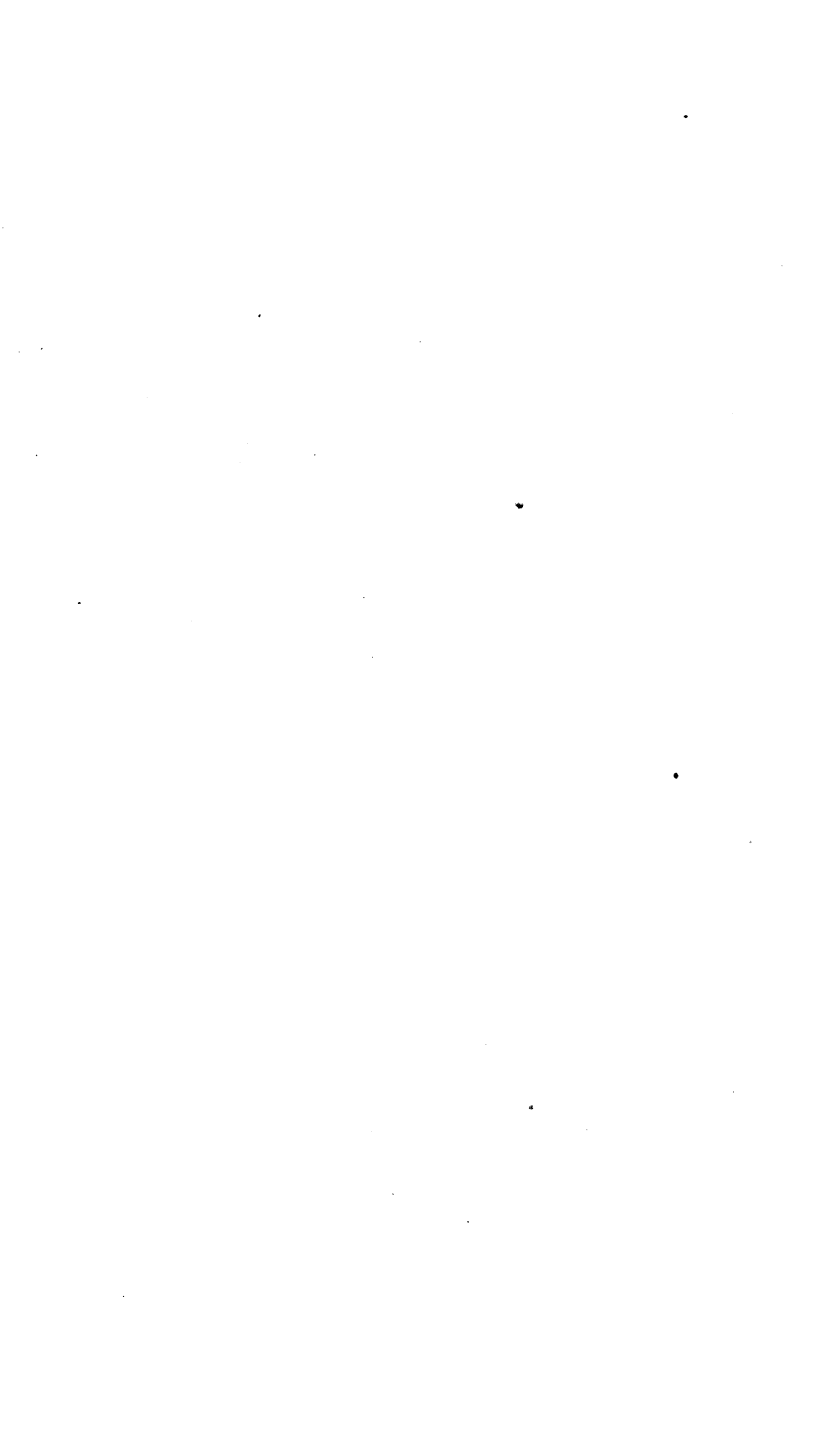


Plate 25. Interior of Office on Alakea Wharf.



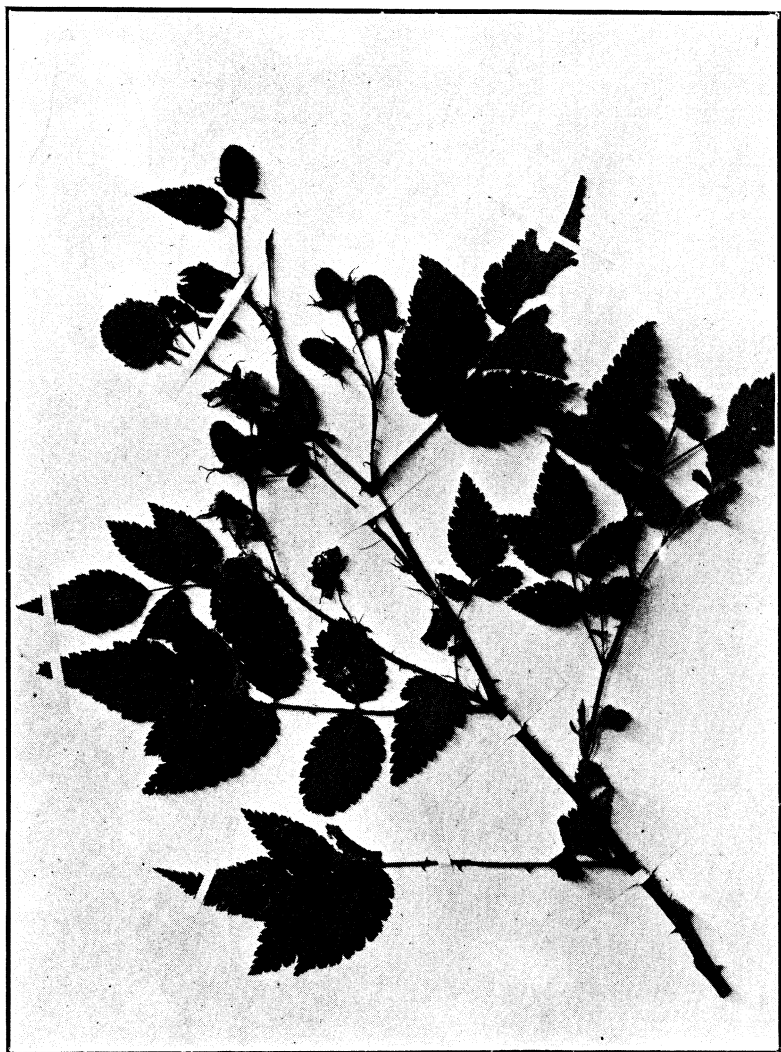


Plate 26. Thimbleberry.
Rubus jamaicensis.

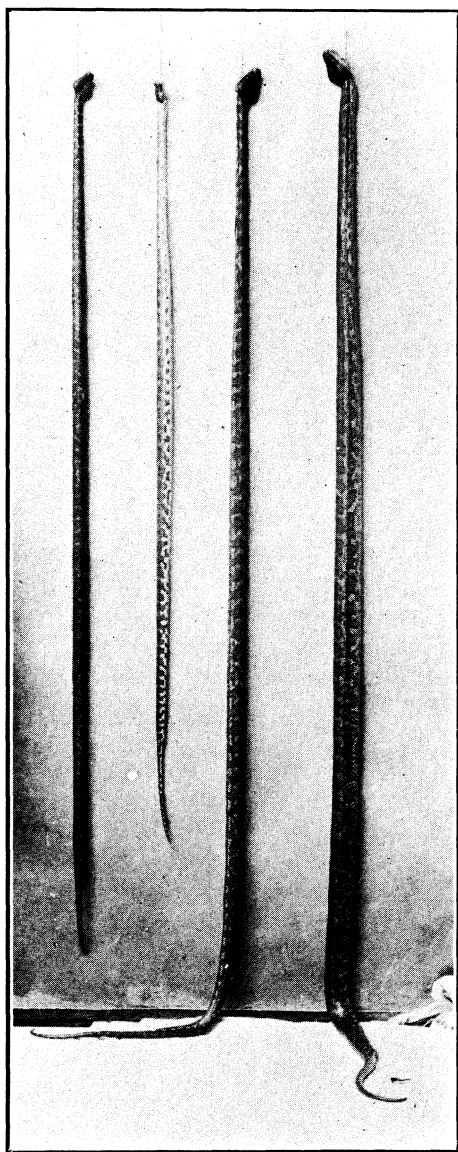


Plate 27. Australian Snakes Prevented from Entering Hawaii by the Board of Agriculture and Forestry.

is confiscated and cane and package is immediately destroyed by burning.

Banana Borers and Disease.

Several lots of banana sprouts have been taken from passengers during the year. The rule and regulation prohibiting the importation of such from Oceanica is a very good law, as we invariably are able to find the Banana borer, *Sphenophorus sordidus*, in the plants. There now exists a serious disease of the Banana in Central America and the West Indies, and on the recommendation of your Superintendent, a rule and regulation prohibiting the introduction of fruit and plants from these sections, where thousands of acres have been killed off during a year's time, has been passed by the Board and awaits the approval of the Governor.

Snakes.

On July 19th of this year a consignment of five large poisonous snakes in the possession of a showman arrived on the steamer "Makura." By order of the Collector of Port, Mr. E. R. Stackable, the reptiles were refused a landing, and he requested your Superintendent to kill them, which was done by the use of a four-strength gas under two-hour exposure. The snakes are now preserved in formaldehyde in the Division Museum.

Hitchcock, or Thimbleberry—Rubus jamaicensis.

For many years this plant has been the greatest pest in the pasture lands of Hawaii, and many thousands of dollars have been expended annually in clearing up the lands in an endeavor to check it. The Board of Agriculture and Forestry has on several occasions been requested to investigate the pest and recommend some plan for its eradication. It was suggested that some insect enemies be introduced to cope with its spread, but on the advice of the entomologist this was discouraged, as insects which would attack Thimbleberry would, on account of its relation to other plants, attack many other species of great value.

During the latter part of this year, my Hilo assistant, Brother M. Newell, reported that certain areas of Thimbleberry on the Volcano road were apparently dying, and the dead plants showed indications of a disease. Immediate action was taken in the matter, and specimens of diseased plants were secured and submitted to Dr. H. L. Lyon of the Hawaiian Sugar Planters' Experiment Station, who, after very careful study, determined the disease as *Clypcosphaeria Hendersonia*, a very common fungus attacking the cultivated Rubus family in the United States. We immediately got interested and busy to see if something could be done

to transfer the disease to infested pasture lands; and to that end we have attempted the inoculation of outdoor sections by transferring diseased portions of plants to the healthy areas. We have also been able to make artificial cultures on agar-agar, and are now inoculating pure cultures of the disease on to growing plants in the laboratory.

We have every hope of success with either method, and could by the latter method, if found practicable, distribute unlimited spores of the disease to all infested districts. Our time on these experiments has been too short to enable us to report in full about the matter, but from what observations have been made, there is hope of success. The Thimbleberry, or Hitchcock berry, has only been recorded from the Islands of Hawaii and Maui, all the other islands being free from it. On Hawaii the following districts have been furnished me by Mr. J. F. Rock, Botanical Assistant of the Division of Forestry: Paauhau No. 1, 2 and 3; Nienie, Haneipoe, Volcano region, Puna and Hilo districts, Waipio (there exists here a double flowering variety), Waimanu, Pololu, Honokanenui, Honokaneiki, and Kohala proper. On Maui it was found in the Keanae District, East Maui, by Mr. R. S. Hosmer, Forester.

FIGS AND FIG INSECTS.

Through the kind coöperation of the Bureau of Plant Industry, U. S. Department of Agriculture, I have been able to procure a number of new varieties of Capri and Smyrna fig trees and cuttings, which have been planted at Moanalua, where the introduction of the fig wasp is a marked success. We have been able to find the insect present every month of the year, and some very fine, luscious fruit has developed this season. With the new varieties of Capris and other Smyrnas we shall be able to demonstrate the possibility of growing figs of good size and improved flavor. The object of importing other varieties of Capri figs is to materially aid the fig wasp by supplying a continuous crop of capri figs in which the wasp develops.

FRUIT FLIES.

The unfortunate discovery of the Mediterranean fruit fly (*Ceratitis capitata*) on the Island of Oahu makes it advisable to publish a short account of the insect with illustrations. This insect and the Melon fly (*Dacus curcubitae*) are closely related and resemble each other very much. The habits of both, one destroying soft-meated fruit and the other vegetables, such as beans, tomatoes, cucumbers, melons, etc., are very similar. The adult fly punctures the fruit or vegetable and lays a few eggs

therein, these hatch into maggots, which soon cause a decay spot in the fruit, and before it ripens it generally drops to the ground; vegetables usually decay long before maturing and become unmarketable. The Melon fly is better known to the growers of these islands, as it has been here for many years. It is probably of Oriental origin, being found in India, Ceylon, and adjacent countries. The Mediterranean Fruit fly is probably a native of Southern Europe or Africa, Spain being the first country from which it has been reported.

Of all the pests that have turned their attention to cultivated fruits or vegetables there is no group that does the damage in as short a period as these. As the maggots are protected in the pulp of the fruit, it is next to impossible for any applied remedies to reach them. Some success has been obtained in using a poisoned sweet bait to attract the adult fly and poison it. In some countries it is claimed that parasites keep these pests in check, and such should naturally be the best and cheapest remedy in the end.

From general observations the work of the Mediterranean Fruit fly can be traced here for at least three years, although the adult was not observed until the middle of this year. Its spread is confined, as far as search has been made, to the vicinity of Honolulu proper. All Citrus fruits are attacked, and we have also bred the fly from guava. In other countries it is reported as attacking all fruits except Bananas, Pineapples and Olives. This pest has become very widely distributed in many countries, and is now recorded from the Mediterranean region, Azores, Southern Africa, East Coast of South America, West Indies, Australia and New Zealand.

The adult fly is about the size of a common house fly, body ochreous yellow, eyes of reddish purple tint, the dorsal surface of thorax is quite raised and of a dirty white color, mottled, with shining black blotches presenting a mosaic pattern. Wings are broad, semi-opaque, with many irregular black blotches and lines and yellow markings. The female has a well-developed ovipositor, with which the fruit is easily punctured. The male and female flies resemble each other, but the first can be readily recognized, by having a pair of well-developed, bristle-like filaments standing out in front of the head, and which end in a diamond-shaped spatulate appendage. The maggot is hard to locate in the pulp of the fruit, as its color and shape resembles the small yellow cells of the orange; it is about half an inch long when full grown. As soon as the maggot has reached its growth it leaves the fruit and crawls into the ground, and very soon turns into a yellowish brown pupa. According to the weather, the time from the egg to the adult fly varies from 30 days to 40 days.

The accompanying plate gives a good illustration of the fly highly magnified with its natural size indicated by a smaller figure. On another page we illustrate the flies at rest on an orange, a very common occurrence when the fruit of the trees is badly infested with maggots.

In coping with this pest, the most advisable method at present is by clean culture, by which is meant the gathering and destroying of all infested fruit. It will readily be seen that if infested fruit is allowed to remain after dropping, the maggots will be able to escape and burrow into the ground, but when all infested fruit is collected, but a small percentage of maggots escape. This method has been successfully carried on in Bermuda; in fact, to such an extent that the pest has been reduced to a minimum.

New Rules and Regulations.

On account of the outbreak of the Mediterranean Fruit fly, *Ceratitis capitata*, the following Rule VII was passed by the Board of Agriculture and Forestry and approved by the Governor.

RULE VII.

RULE AND REGULATION BY THE BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY CONCERNING THE PREVENTION OF DISTRIBUTION OF THE MEDITERRANEAN FRUIT FLY FROM OAHU TO THE OTHER ISLANDS.

The Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii hereby make the following rule and regulation:

Section I. For the purpose of preventing the spread of the Mediterranean Fruit fly (*Ceratitis capitata*) from the Island of Oahu, Territory of Hawaii, where the same has established itself, to any other Island in the Territory, all persons and corporations are hereby prohibited from carrying or shipping oranges, lemons, limes, mangoes, alligator pears, guavas, peaches or other soft-meated fruits grown on said Island of Oahu to any other Island in the Territory.

Section II. Any person or corporation violating the above rule shall be guilty of a misdemeanor, and shall be punished by a fine not to exceed Five Hundred Dollars, as provided by Section 390 of the Revised Laws of Hawaii as amended by Act 82 of the Session Laws of 1905 and Act 112 of the Session Laws of 1907.

Section III. This regulation shall take effect from and after the approval thereof by the Governor.

Approved:

W. F. FREAR,
Governor of Hawaii.

Honolulu, Territory of Hawaii,

November 21, 1910.

By the enforcement of this rule we are hopeful of checking the spread of the Fruit fly to the other islands. As there is no provision made for County or inter-island inspection of fruits and plants, it is rather a difficult task to absolutely prevent the shipment of fruits from Oahu, but I am pleased to say that after having notified the various steamship companies of the new ruling, I have received the greatest assurance of their sincere coöperation, and any and all fruit which is attempted to be shipped will not be accepted for shipment and that which is found in the possession of passengers on the boats will be confiscated and destroyed.

On account of the existence of a serious and infectious plant disease on Banana in many parts of the world, which disease is rapidly spreading throughout the infested areas, necessitating the abandonment of thousands of acres of banana plantations therein, on recommendations of your Superintendent, the Board passed the following Rule VIII,* by the enforcement of which we shall be able to protect our Banana industry, which I am pleased to say has but few pests and which has a very promising future.

RULE VIII.*

RULE AND REGULATION BY THE BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY CONCERNING THE IMPORTATION OF ALL BANANA FRUIT, BANANA SHOOTS OR PLANTS.

Whereas, this Board has by notification of the United States Department of Agriculture and by its own investigation been apprised of the existence of a serious and infectious plant disease on banana in many parts of the world, which disease is rapidly spreading throughout the infested localities, necessitating the abandonment of thousands of acres of banana plantations

* Rule VIII was approved by the Governor while this report was in press.

therein, and is extending to other localities, and inasmuch as the existence of this disease in imported plants and fruit cannot be ascertained by local inspection nor eradicated by fumigation, and no good method of control of the disease has yet been found;

Therefore, the Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii hereby make the following rule and regulation:

Section 1. For the purpose of preventing the introduction into the Territory of Hawaii of a banana disease known also as banana blight, and determined as *Fusarium cubense*, all persons, companies and corporations are hereby prohibited from introducing or importing into the Territory of Hawaii, or into any of its ports for the purpose of debarkation into said Territory any fresh banana fruit, banana sprouts or plants, from Central America, including the Panama Canal Zone, the West Indies, Dutch Guiana, or any other locality where the said disease exists or may become known to exist.

Section 2. This regulation shall take effect from and after the approval thereof by the Governor.

MARSTON CAMPBELL,

President and Executive Officer.

Board of Commissioners of Agriculture and Forestry.

Approved:

W. F. FREAR,
Governor.

January 25, 1911.

Beneficial Insects.

The following is a record of the beneficial insects released in various places in the Territory during the year 1910:

Pimpla behrenzii and *Chalcis ovata*, two very effectual parasites of the Oak moth; *Phryganidia californica* in California were introduced with the hope that they would assist in keeping in check the Cocoanut Leaf Roller, *Omiodes blackburni*, and other destructive leaf rollers. Many strong colonies were liberated in several cocoanut groves on the Islands.

Pteromalus puparum, the most important factor in the control of the Cabbage butterfly, *Pontia rapae*, on the mainland, was introduced and has been released in the vicinity of the largest market gardens. In addition to this a large number of these parasites were reared in the laboratory and distributed wherever *Pontia rapae* attacked cabbage and nasturtiums.

Very large shipments of *Hippodamia convergens*, a valuable Aphis eating ladybird from California, have been received during the year and large colonies containing many thousands have been sent to all places where proper food could be found.

Mr. Albert Koebele sent from Europe a few colonies of parasites for scale insects. They were released on *Coccus acuminatus*, *Saissetia nigra*, and *Pulvinaria psidii*. A wingless Encyrtid was also bred from the material sent, but as it might possibly prove a secondary or hyperparasite, it was not liberated:

The following colonies of beneficial insects were distributed during the year:

Horn Fly parasite, <i>Eucoila impatiens</i>	4 colonies
Scale insect parasite, <i>Scutellista cyanea</i>	3 "
Leaf-roller parasite, <i>Pimpla behrenzii</i>	5 "
Ladybird, <i>Cryptolacmus montrouzieri</i>	4 "
Ladybird, <i>Novius cardinalis</i>	10 "
Cabbage Butterfly parasite, <i>Pteromalus puparum</i> ..	7 "
Aphis eating Ladybird, <i>Hippodamia convergens</i>	26 "
Scale insect parasites from A. Koebele.....	7 "
Japanese Beetle Fungus	12 "
Making a total of 78 colonies and an aggregate of 160,954 insects.	

Beneficial Insects Established.

After a careful search we have ascertained that two valuable scale-eating Ladybirds, *Azya luteipes* and *Hyperaspis jocosa*, have become well established in the vicinity of Honolulu. *H. jocosa* in Nuuanu, Manoa, Makiki, and Waikiki, and *A. luteipes* at Ainalahu.

The following is a report of Dr. R. C. L. Perkins concerning the importation and distribution of Hornfly parasites received from Mr. Koebele during 1910:

REPORT ON THE IMPORTATION AND WORK OF HORNFLY PARASITES FOR 1910,

By

DR. R. C. L. PERKINS,

Entomologist, H. S. P. A. Experiment Station, Honolulu.

During 1909 the parasitic and predaceous insects sent over from Europe by Mr. Koebele were attended to by Mr. Swezey, who has already submitted an account of these. He made a last distribution of the parasite, *Bathymetis*, on January 26, 1910, after which the parasites went into a dormant condition, or hibernation, and

their breeding was suspended. In May, however, the parasites again began breeding in captivity, and it became possible later on to send colonies to Kauai and Molokai, which previously had received none. This species of parasite proved difficult to handle in captivity, partly owing to the fact that an enormous surplus of males were always bred. In some cases the males outnumbered the females by twenty to one, and some quite large colonies produced no females at all. As only the fertile females were of use for distribution, it became very difficult to obtain a sufficient number of these, at any one time, to make up a satisfactory colony for distribution. At the end of the summer, owing to the excessive production of males, the species died out in confinement. This, however, owing to the distribution that had been already made, was not of much consequence. The insect being an active flier, if once established and acclimatized, would very quickly spread over any island on which it had been placed, and would need no special distribution of colonies. I should expect that it would be more likely to flourish at good elevations in the mountains rather than on the low lands, and careful search should be made to see whether it has become established in the former situations.

During 1910, Mr. Koebele has continued his work in Europe on the natural enemies of horn fly and the flies associated with these, the larvae of which have similar habits and similar natural enemies. During the summer months, when it is impossible to transmit living specimens from Europe to the Islands, his time was spent in collecting and breeding material, so as to have this ready for transmission against the coming of colder weather. In May an attempt was made to send over some predaceous insects, but, as was expected, all died on the journey. From the condition of the dead, I concluded that the insects had lived till after their dispatch from San Francisco and had died between that port and Honolulu. Although a number of other consignments were sent over, it was not until October that it became possible for the contents to reach here alive. These facts are quite in accordance with what had been noted in the previous year.

During October and November we have received from Mr. Koebele the main part of the material that he had gathered and reared during the preceding summer months. A number of different parasites and predaceous insects were received alive in these consignments. The predaceous species consisted of (1) *Hydrophilidae*, (2) *Hiteridae*, (3) *Staphylinidae*; the parasites of (1) *Ichneumonidae* (*Atractodes*), (2) *Alysiidae* (*Alysia*), (3) *Cynipidae* (*Eucoila*). None of these insects are suitable for breeding in confinement, excepting perhaps the *Eucoila*, and con-

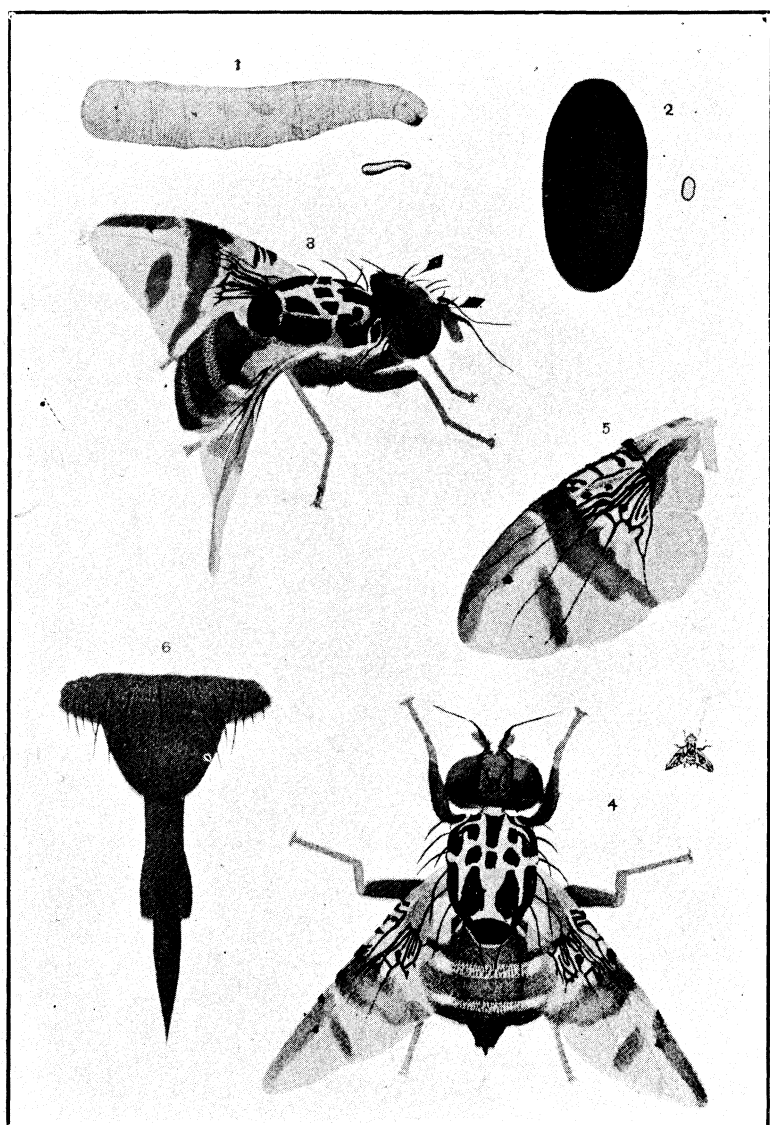


Plate 28. Mediterranean Fruit Fly; all stages.
After C. W. Mally, Cape Town.

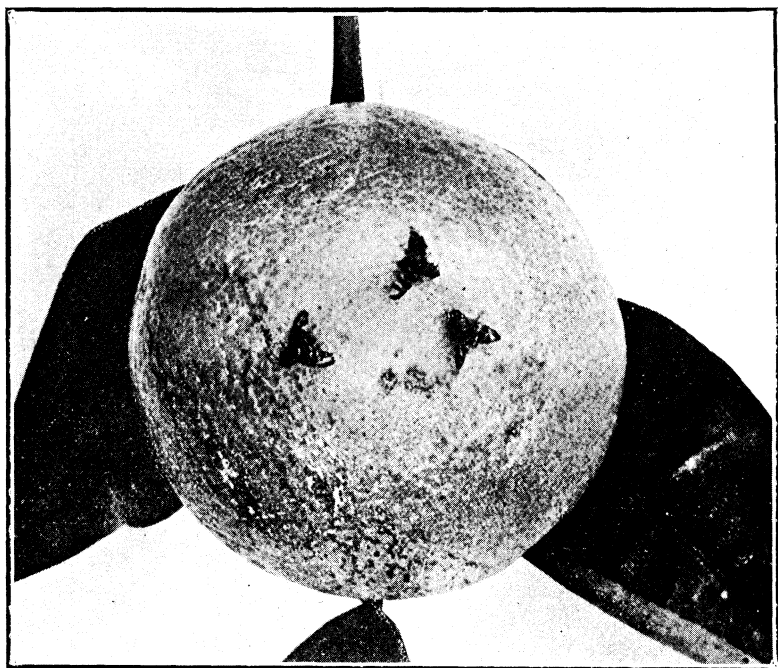


Plate 29. Orange Showing Adult Fruit Flies at Rest.

After W. B. Gurney, Agr. Gazette, N. S. W.

sequently it has been necessary to liberate them as soon as they have been received, or as soon as they have become adult, when consigned in their earlier stages.

All the predaceous insects and the parasite *Atractodes* were dispatched at once to Maui and liberated on Haleakala. This was done because it was certain that there, if anywhere, they would find a suitable climate. The *Alysia* unfortunately could not be sent there, as it was necessary to liberate the specimens at once, and there was no steamer leaving for the other islands. This parasite was therefore liberated in Nuuanu. The *Eucolia* has only lately been reared, and there is hope that more of this and other parasites may emerge from some of the material sent by Mr. Koebele, this material being still in good condition. After a reasonable time an exhaustive search should be made in all the localities, where the parasites have been liberated, in order to learn whether these have become established.

It would appear to me that most, if not all, of the North European insects, liable to attack horn fly, have now been given a trial, and that henceforth research should be made in hotter countries, especially in the extreme south of Europe and in Northern Africa. The great diversity of climate that is found on different ranches or parts of a ranch, owing to elevation and other causes, makes it absolutely necessary that a considerable variety of enemies should be introduced, for these are likely to be more particular as to their environment, than is the horn fly. It is quite certain that the species hitherto sent over are more likely to do good on the upland ranches than on those at or near sea level.

R. C. L. PERKINS.

Insect Collection.

Our collection of insects consists of about 6424 mounted specimens, comprising: Insects indigenous to the Hawaiian Islands, those of economic importance found in the Territory, foreign insects of economic importance and insects intercepted in inspection of importations of fruit, plants and vegetables.

The Hawaiian insects have been transferred from the small Schmidt boxes to the cabinet and arranged in their proper orders, families and genera. Many unmounted specimens have been cleaned and mounted, and a large number of species have been identified and properly labelled. Special attention has been given to insects of economic importance, and all available time has been spent in procuring material to show their life history, habits and natural enemies.

Besides the large collection of ladybirds (*Coccinellidae*), many insects of economic importance from Mexico, South America and other countries have been added. These make a valuable aid to the work of inspection, as they enable us to become more familiar with pests likely to be found on introduced plants from other countries and to enable us to more quickly recognize them, or evidence of their presence in these shipments.

We also have a large number of insects found on imported fruits and plants showing portions of plants, fruits, etc., and demonstrating their injury. In addition to this we also have numbers of diseases of plants, generally preserved in alcohol in small museum jars.

For breeding life history of various pests we have had constructed some very useful wire cages, as we find that breeding jars are apt to become too damp and experiments very often are rendered worthless through the loss of valuable material.

We have also added a modern high-pressure spray outfit and a Champion dry dust-sprayer, and with this equipment we have been able to carry on some very useful field experiments, as recorded in the Report of the Assistant Entomologist, which is attached hereto.

Acknowledgments.

I desire to express my gratitude for assistance given us by individuals and institutions. To the Division of Entomology and Plant Pathology of the Hawaiian Sugar Planters' Association Experiment Station, to Dr. L. O. Howard and staff of the Bureau of Entomology, U. S. Department of Agriculture, and to the Hawaii Agricultural Experiment Station, for kind coöperation, advice and identification of insects and plant diseases. To the Superintendent of Public Works for his great aid in furnishing us adequate quarters on the docks, and to the U. S. Customs, Immigration and Postoffice authorities and Steamship Companies for their great aid and coöperation in our important work. To Mr. E. K. Carnes, Supt. California Insectary, and his assistant, for the supply of large quantities of Ladybirds.

Recommendations.

Owing to the steady increase of fruit and plant shipments arriving in the Territory the need for a dock assistant is very apparent, and I hope that the Board will be able to prevail upon the incoming Legislature to make provisions for such an office.

The constant complaint of the ravages of the Melon Fly, the Alligator Pear mealy bug, and Japanese Beetle would warrant the expenditure of considerable time and money in the search for parasites for these pests, and now that the Mediterranean Fruit Fly has established itself, a parasite for this pest would materially help in preventing its spread to other sections. I believe

that no time should be lost, and that the Board should ask for the necessary appropriation for such work.

In addition to the above, I find that the insectary on the grounds of the Government Nursery does not assist us in the propagation of parasites, and even for field experiments we have been somewhat hampered for the necessary room in breeding out the life history of various pests. If we are to extend the distribution of parasites and continue in other lines as started this year, a larger and better equipped insectary will be an absolute necessity.

The advisability of establishing either County or inter-island inspection has been brought to the attention of the Board in the reports of the last few years. There are pests and diseases on some of the islands which do not exist on others, and by such inspection under either County government or by extending the powers of the present Territorial laws, many such pests could be prevented from being spread. With the constant influx of immigrants from all quarters of the globe, the chances for some pest to be brought in unnoticed, either hidden among wearing apparel or even in the pocket of an individual, are very apparent. It is probable, through this very means, that the Mediterranean fruit fly gained admission into Oahu. This pest is only found in the vicinity of Honolulu, and, although the Board has passed a regulation prohibiting shipments of Citrus and other soft-meated fruits from Oahu to any of the other islands, we have no officers stationed on these islands who can enforce this law, and only through the coöperation of individuals and the Steamship Companies are we hopeful of preventing the spread of this pest.

Very respectfully,

EDW. M. EHRHORN,

Superintendent of Entomology.

THE INTRODUCTION OF BIRDS INTO THE HAWAIIAN ISLANDS.

At a meeting of the Board of Agriculture and Forestry, held on November 21, 1910, the matter of the introduction of useful birds into Hawaii was brought up, and after a lengthy discussion the Board appointed Mr. E. M. Ehrhorn, Superintendent of Entomology, a committee to investigate and inquire into the possibilities of bird introduction. At the meeting of December 28, 1910, Mr. Ehrhorn submitted the following report from Prof. H. W. Henshaw, who is too well known here to

need an introduction and who is the Chief of the Bureau of the Biological Survey, U. S. Department of Agriculture, Washington, D. C.:

UNITED STATES DEPARTMENT OF AGRICULTURE.

Bureau of Biological Survey.

Washington, D. C., Dec. 5, 1910.

Mr. Edward M. Ehrhorn, Superintendent of Entomology, Board of Commissioners of Agriculture and Forestry, Honolulu, Hawaii.

Dear Sir:—Your letter of November 22 requesting information as to the desirability of importing foreign birds into the Hawaiian Islands for the purpose of destroying noxious insects is received. In reply I have to state that the habits and standing of a bird in its native home never afford absolutely safe criteria from which to judge what it may do in a foreign country where its habits may change considerably; hence, the importation of any species must always be regarded as an experiment to be carefully watched till the bird has become well established in its new home and its habits there thoroughly known.

It may be set down as an axiom that the introduction of birds, in large part seed and fruit eaters, into any agricultural country is to be avoided, since both birds are almost sure to prove a nuisance by attacking fruit and grain crops. The English sparrow is a well known instance of the harm that may come from the introduction of a natural seed eater, only to a comparatively small extent insectivorous, into the United States. Although introduced also into the Islands, this bird has apparently not thriven and increased there as it does in a colder climate, and hence so far has done comparatively little harm. Much the same statement applies to the California house finch now domiciled in several of the Islands. It is a serious nuisance in parts of California because it destroys large quantities of small fruits, and in time it may become a nuisance in the Islands.

Neither the bobolink nor any species of blackbird should be considered for a moment as a candidate for introduction. The former is a pest to the rice planter. In 1880, when the rice crop of South Carolina was valued at upwards of six millions of dollars, this bird it was estimated destroyed at least one-third of the crop, to the value of two million of dollars.

The Brewer's blackbird might possibly prove an exception to the rule, but it is exceedingly gregarious in fall and winter,

and any birds that assemble in large flocks are to be regarded with suspicion as they are capable of inflicting great damage on crops when they turn their attention to them.

I can see no harm likely to result from the introduction into the Islands of any of the small spotted woodpeckers, as for instance, Gairdner's woodpecker (*Dryobates pubescens gairdneri*), and Nuttall's woodpecker (*Dryobates nuttalli*), both of which birds might be obtained in California and both are very useful.

So far as scale insects are concerned, and other small insect pests, I can unreservedly recommend any of the chickadees, as the plain titmouse (*Baeolophus inornatus inornatus*), mountain chickadee (*Penthestes gambeli gambeli*), California chickadee (*Penthestes rufescens neglectus*), the bush-tit (*Psaltriparus Minimus minimus*), also the wren-tit (*Chamaea fasciata fasciata*). Both the latter species abound near San Francisco. I should not hesitate to recommend also any of the flycatchers, or phoebes, like Say's flycatcher (*Sayornis sayus*), the black flycatcher (*Sayornis nigricans*) of California, and the ash-throated flycatcher (*Myiarchus cinerascens*). These three species are, it is true, migratory, and it is by no means certain that they would forego the migratory instinct and consent to remain in the Islands. On this account it would be better to select tropical non-migratory flycatchers, as species of the genus *Myiarchus*, *Pitanga* and *Myiozetetes*, all of Mexico. The Vermilion flycatcher of Texas, Arizona and Mexico, besides being very beautiful, is an active flycatcher living much in rather open fields and is non-migratory over much of its range. The little Australian flycatcher you mention might also prove a very desirable inhabitant of the Islands, and it is very likely to thrive there, as the little flycatcher, or elepaio, now dispersed over the uplands of several of the Islands was probably derived originally from Australian stock.

Any species of swallow or nighthawk could be introduced with perfect safety and with the certainty of yielding valuable service, since these birds live almost exclusively on insects. Unfortunately our American species are migratory, but the purple martin of northern Mexico is non-migratory, is a greedy insect eater, and could be rather easily obtained and transported, especially when young. The same statement may be made of a tropical swallow living on the coast of Mexico (*Tachycineta albilinea*). I should personally like to see an attempt made to introduce one or more of the several species of California humming-birds into the Islands, although the desirability of doing this rests more upon aesthetic than economic grounds. They live to a considerable extent upon minute insects which they find within the corollas of flowers, and also upon the nectar of flowers. I do not doubt for a moment that they would thrive wonderfully

well in the gardens about Honolulu, and also in the mountain districts where the Ohia abounds, the flowers of which would furnish them an abundance of food. Nor do I see any difficulty in the way of transporting them by steamer to Honolulu, as they could be fed upon water sweetened with sugar during the six days of the voyage.

An attempt to acclimatize the mocking bird in the Islands would be sure to arouse popular interest, would probably be successful, and would be attended with comparatively little risk. It is almost exclusively insectivorous during the breeding season and largely so the year round. The mocking bird would be a fine addition to the Island avifauna, though it cannot be recommended unreservedly.

There is another bird which I think worthy of trial, about the size of a blue bird and known to dealers as the "Pekin nightingale" or "Japanese robin." Its scientific name is *Liothrix lutea* and it is somewhat related to the thrushes, but is probably nearer the flycatchers. It lives to some extent on small fruit and insects. It would be easy to obtain this bird from San Francisco bird dealers. There are a good many wild berries in the Islands, including the native blackberry or akala, the introduced Jamaica raspberry, the introduced mulberry and the native species, together with a number of berry bearing trees, the names of which I have forgotten. These should furnish abundant food for such berry eaters as the ones just mentioned, and would greatly lessen the chance of their attacking cultivated ones.

The game birds, like the turkey, pheasants and quail, so far introduced into the Islands, have suffered from the mongoose, since they nest on the ground, and, together with the native Hawaiian goose, are likely to ultimately undergo practical extermination. Should further introduction of game birds into the Islands be contemplated, I would suggest trial of the following, all inhabitants of Mexico: Chachalaca (*Ortalis*), guan (*Penelope*), and curassow (*Crax*). These gallinaceous birds are to a considerable extent forest inhabitants, would furnish excellent sport, and are fine eating. The curassow would probably thrive best in humid regions, the chachalaca in dryer parts. All these are tamed readily, and in Mexico frequently live about the houses of the residents, mingling freely with the domestic fowls. They feed on wild berries and insects, and *nest well up in forest trees*. This latter fact makes them particularly good subjects for trial in the Islands, as they would be largely exempt from attacks by the mongoose.

It is impossible to predict beforehand the probable results of an attempt to establish the foregoing species in the Islands, though I see no reason why any of them, except the migratory

species which are doubtful, may not thrive there. Sometimes, however, two or three attempts to establish a species in a foreign country have to be made before the bird is finally acclimatized. It may be said that the general history of efforts to acclimatize birds in foreign parts shows many more failures than successes. It has always unfortunately proved easier to secure and import the hardy seed eaters, which can be bought in almost any bird store, than the more delicately organized insectivores, which explains largely why so many disastrous importations have been made in different parts of the world. The introduction of really useful species, on the other hand, cannot be attempted without entailing considerable expense and trouble. Hence the rarity of properly conducted experiments.

Should attempts be made to import into the Islands any birds from California, I would suggest that you can probably obtain all necessary information as to where they can best be secured from Mr. Joseph Grinnell, of the Museum of Vertebrate Zoology, University of California, Berkeley. I have no doubt that Miss Annie M. Alexander, Oakland, California, through whose generosity the museum has been established, would take great interest in the matter. I shall be glad to supply any further information on the subject or to aid in any way within my power.

Very truly yours,

H. W. HENSHAW,
Chief, Biological Survey.

Report of the Assistant Entomologist.

Honolulu, T. H., December 31, 1910.

Mr. E. M. Ehrhorn,
Superintendent of Entomology,
Honolulu, T. H.

Sir:—I submit the following report concerning the principal entomological projects I have undertaken since my appointment as Assistant Entomologist in July, 1910.

During the past few years I have worked almost exclusively on insects affecting sugar beets and truck crops. After my arrival in the Islands I at once looked over the ground with the intention of continuing my studies of truck crop pests, if possible. It was soon evident that work along this line offered splendid opportunities and was badly needed. It was also plain that a study of insects affecting ornamental plants offered many opportunities. Accordingly, my efforts have been directed chiefly along these two lines, although I have been practically compelled to devote some time to work on insects affecting alligator pears, guavas and mangoes.

In order to effectively carry on the work as indicated above it has been necessary to spend a large proportion of the time in the field taking notes, making experiments with numerous insecticides and in demonstrating to the growers the proper methods of preparing and applying the insecticides. It may be worth while to state that with all the experiments except two, I personally prepared and applied the solutions or mixtures and noted the results. Owing to the inconclusive results that too often occur from trusting such work to unskilled help, I have considered it necessary to make these tests personally. Hundreds of gallons of the insecticides have been prepared and applied, and it is needless to say that this has necessitated a considerable amount of physical labor.

The experimental work has been supplemented by careful life history studies of several of the more injurious species of insects, and considerable time has also been devoted to mounting or otherwise preserving specimens and in writing notes, letters and reports.

To an Easterner, and to one accustomed to the spick and span, almost weedless commercial truck gardens which are maintained by the better class of truck growers on the mainland, the condition of many of the gardens in the vicinity of Honolulu is almost

startling. Most of these gardens are managed by Chinese and Japanese, and in many cases it would seem that they still practice the same cultural methods that have been in use for centuries in their own countries.

It often happens that after a crop has reached a stage where the first fruits are beginning to mature that no further cultivation is given, but weeds and grass are allowed to grow in abundance, and thus, apparently, a good proportion of the crop is prevented from reaching maturity.

These people also appear to have very little appreciation of the necessity of cleaning up the odds and ends after the crop has been harvested. As a result it is not unusual to find an abundance of the unsalable remains standing in the beds long after the salable portions have been disposed of and thus offering an ideal place for various insect pests to breed and be in readiness to damage later plantings.

A striking case of this disregard of clean culture is to be seen in the manner in which the melon fly (*Dacus cucurbitae*, Coq.) is often treated. It very frequently happens that the worst infested cucumbers or other cucurbits are carefully gathered, but instead of being destroyed promptly they are placed in neat rows about the edge of the beds where the flies have every opportunity to issue and infest the remaining portion of the crop.

Another case will also illustrate this point. During the present season a half-acre patch of small, recently transplanted cabbage plants was found to be generally infested by the larvae of the imported cabbage web-worm, (*Hellula undalis*, Fab.) or "center-worm," as it is sometimes called locally. At the time I first examined this cabbage, the larvae were small, very few being over four or five days old. As noted above, the infestation was general and throughout the patch there were probably not twenty uninjured plants. To one who understood the habits of this pest it was plain that very little, if any, of the cabbage could mature, and it was advised that the plants be promptly pulled up and burned. This advice, however, was not heeded, and the stunted and worthless plants were allowed to stand for several weeks. As a result thousands of the moths reached maturity and formed an excellent supply to infest other plantings.

Of course, there are some exceptions, but as a general rule the lack of clean culture is all too apparent.

At present it is very evident that to make truck growing a more profitable industry in the Islands it will be necessary to educate the growers to the intelligent use of methods of combating the insect pests and to a fuller appreciation of clean culture.

The principal insect pests I have studied since being in the

Islands are as follows: the Japanese beetle (*Adoretus tenuimaculatus*, Waterh.); the melon fly (*Dacus cucurbitae*, Coq.; the alligator pear mealy-bug, (*Pseudococcus nipae*, Mask); the chrysanthemum plant louse, (*Macrosiphum sanborni*, Gillette); the beet worm, (*Hymenia fascialis*, Cramer); the common cabbage worm, (*Pontia rapae*, Linn); the imported cabbage web-worm, (*Hellula undalis*, Fab.), and a variety of other caterpillars, cutworms and plant lice affecting cabbage.

The field work on the Japanese beetle consisted of spraying experiments with Paris green and with arsenate of lead applied both by spraying and dusting. A concentrated commercial lime sulphur solution was tested as a repellent, and the collection of the beetles by hand methods was investigated.

The experiments with Paris green were practically failures as this material appeared to act only as a repellent and the beetles refused to eat it under natural conditions. The experiments with arsenate of lead were also failures. The beetles fed on the sprayed or dusted leaves apparently about as readily as on unpoisoned foliage, but as far as could be determined, the poison caused them little or no damage. In the spraying experiments the arsenate was applied at the rate of 5, 10 and 15 pounds in 100 gallons of water and in several cases repeated applications were made to the same plants.

Lime and sulphur when used at the rate of 1 part of the concentrated solution to 30 parts of water served to a limited extent as a repellent, but the benefit, on the whole, was so slight that this material can hardly be recommended.

It is a common practice for people having a few rose bushes, or other choice plants, to go out after dark with a lantern and pick the beetles from the plants by hand. This method, although slow and applicable only to small plantings, is fairly effective. By using a large pan with a small quantity of crude petroleum on the bottom it is possible to do somewhat quicker work. The pan should be held under the bush, where the beetles are feeding, and the bush then struck with a stick. The beetles will drop into the pan, and after they have come in contact with the oil they can never get out.

All of the above experiments were made on rose bushes in a garden at Honolulu.

In the insectary the life history of this beetle was carefully studied. Beetles were confined and eggs readily obtained. The eggs were scattered loosely about in the soil and when first deposited are dull white and oblong in shape. After a few days they increase noticeably in size and become nearly round. They hatch 7 or 8 days after being deposited. The larvae require from 90 to 100 days, when fed on well rotted cow manure, to

reach maturity. They then form a rather compact earthen cocoon and pupate partly within the larval skin. The pupal stage lasts from 16 to 20 days. It will thus be seen that it requires from 16 to 18 weeks from the time the eggs are deposited until the beetles reach maturity.

The specimens noted above were confined in open wire cages in an open air insectary where the conditions were comparatively normal.

I also made some laboratory tests of the Japanese beetle fungus (*Isaria sp.*). In these tests the spores of the fungus were spread on fresh foliage. This foliage was then fed to beetles confined in cages. These beetles died within a few days and were soon covered with the fungus. In check cages beetles were fed on uninfected foliage and these specimens were alive and in healthy condition long after the ones in the test cages were dead. Of course, tests of this nature are not conclusive, but the results appeared so promising that it would seem desirable to continue the investigation along this line.

The field work on the melon fly consisted of tests of poisoned baits and of a trap crop.

The baits were prepared by sweetening water with molasses and adding to the solution arsenate of lead or Paris green. These baits were then applied, at frequent intervals, to the foliage of infested cucumbers with a gardener's syringe. With the aid of the syringe the poisoned liquids were shot into the air above the beds of cucumbers and allowed to fall on the foliage in fine drops. In the experiment with Paris green the application was made daily from September 9 until October 14. The formula used in this experiment was as follows:

Molasses,	1 quart
Paris green,	$\frac{1}{4}$ ounce
Water	$1\frac{1}{2}$ gallon

Neither the experiment with arsenate of lead or with Paris green proved effective. The flies were frequently observed feeding on the poisoned liquids, but evidently they did not relish them, and so failed to consume a fatal dose.

In another experiment wads of absorbent cotton were fastened on short sticks and the cotton saturated with sweetened water which was heavily poisoned with Paris green. These baits were then placed among infested cucumbers, but the flies paid no attention to them whatever.

A test of a trap crop was made by planting cantaloupes among cucumbers. It was thought that the cantaloupes would prove more attractive to the flies than the cucumbers, but such was not the case, as the cucumbers were more badly damaged than the

cantaloupes, and in the end both crops were practically destroyed by the larvae.

In the insectary an effort was made to work out the life history of this fly, but little progress was made owing to the fact that the cages in which the specimens were confined were too small. In the cages the flies fed eagerly on molasses, and in some cases confined specimens lived on this food for nearly two months. Other specimens were repeatedly observed feeding on ripe tomatoes and broken cucumbers.

Owing to the frequent complaints concerning the alligator pear mealy-bug, it was thought necessary to devote some study to this very injurious and conspicuous pest. Accordingly, a rather extensive series of spraying experiments were made with a variety of insecticides, including "Spra-mulsion," Scalecide, San U Zay scale oil, "Black Leaf 40," Carbolic acid emulsion, Black Leaf and "Spra-mulsion" in combination, "Black Leaf 40" and "Spra-mulsion" in combination, and kerosene emulsion. The three first mentioned materials are miscible oils.

"Spra-mulsion," when used at 1 part of oil in 15 parts of water, quite badly injured the foliage of alligator pear and did not kill a satisfactory proportion of the "bugs,"

Scalecide, when used at 1 to 24, and San U Zay scale oil, when used at 1 to 30, killed every "bug" that came in contact with the spray, but caused rather extensive injury to pear foliage.

"Black Leaf 40," when used at a strength of $1\frac{1}{2}$ ounce in 4 gallons of water, was very effective. Small trees can be freed of "bugs" by a single, very thorough application, but with large trees two applications are necessary. This solution injured the foliage of alligator pears somewhat, but caused no damage to guavas or other resistant plants. When using this spray, it is necessary to add about 1 ounce of whale-oil soap to each gallon of the solution, so that the spray will adhere to the insects.

"Black Leaf 40," when used at the rate of 1 ounce in 4 gallons of water, proved only partially effective.

Carbolic acid emulsion used at the rate of 1 part of the stock emulsion in 10, 15 and 20 parts of water was ineffective.

Black Leaf 1 part, "Spra-mulsion" 2 parts, and water 60 parts was partially effective, but is too expensive for general use and cannot be recommended.

"Black Leaf 40" 1 part, "Spra-mulsion" 1 part, and water 60 parts was likewise ineffective.

Kerosene emulsion used at 1 part of stock in 10 parts of water and at 1 part in 8 of water proved fairly effective, and caused little or no damage to the pear foliage. In these two tests several hundred gallons of the diluted emulsion were applied, under my direction, to about 100 alligator pear trees. Some of these trees were very large.

I have not completed my study of this mealy-bug and, as yet, have not come to a final conclusion as to the best remedy. "Black Leaf 40" is entirely effective when used at a sufficient strength, but is too expensive for use on a large scale. Some of the miscible oils are effective, but damage the tender pear foliage to a greater or less extent. On guavas and other resistant plants they are safe, and it is very probable that in the end one or more of these oils will prove the most satisfactory remedy.

The chrysanthemum plant louse was studied and the results of my observations and experiments are embodied in a separate article and will be appended to this report.

The beet worm was also studied. These larvae are apparently always to be found on beets, *Amaranthus* or other weeds. On the beets they feed almost exclusively on the under surface of the leaves and, except when nearing maturity, do not eat through the upper epidermis. Experiments which I made against this destructive pest showed that it can be easily controlled by spraying with Paris green at the rate of 2 pounds in 100 gallons of water. It is absolutely necessary to apply the poison to the *under* surface of the leaves. Applications made only to the upper surface of the foliage will not control this insect. When spraying for this species, it is desirable to add from 5 to 8 pounds of whale-oil soap to each 100 gallons of the mixture. The soap aids the spray in adhering to the foliage, and a very even distribution of the poison is obtained.

I have taken up the study of insects affecting cabbage in a manner to cover, as far as possible, the entire subject; it being my intention to prepare a bulletin concerning these pests as soon as sufficient material has been accumulated.

Probably our most pernicious, although not most destructive, pest of this crop is the imported cabbage web-worm. The larvae bore into the bud or mine into the leaves of the older plants. In very small plants, in the seed beds, they live within folded leaves. All of my experiments with Paris green were failures. The larvae were so completely protected that they were beyond the reach of the poison. In the older cabbage plants not a larvae was killed, while with very small plants, from $\frac{1}{2}$ inch to 2 inches in height, a few specimens fed on the poisoned foliage and died. At the present time we have no effective remedy for this pest. The seed beds can be protected by screens. These should be made by placing 12 or 14-inch boards, on edge, along the sides and ends of the beds. All the joints should be very tight. Over the top of this framework of boards a strip of fine wire screen should be stretched and tightly tacked down. It is also a good plan to have a few unprotected cabbage plants outside of the screened beds. These plants will be very apt to become

infested, and they should then be promptly burned. If this method is followed it will, at least, be possible to have uninfested plants up until the time of transplanting.

Another pest which has caused immense damage to cabbage is the common cabbage worm, (*Pontia rapae*, Linn). There is no reason why this insect should be allowed to do so much damage. It can be easily controlled by spraying with Paris green, and I have repeatedly demonstrated this fact since being in the Islands. The formula I prefer is as follows:

Paris green	2 pounds
Whale-oil soap	8 pounds
Water	100 gallons

The Paris green is somewhat in excess of the amount usually recommended, but under local conditions this formula has proven very satisfactory. It gives very quick results, and in a climate where rains are so frequent, as in these Islands, quick results are necessary. The mixture should be applied as a fine, forceful spray, and, as far as possible, every portion of the foliage should be wet. The cabbage foliage is so waxy that it is necessary to add some adhesive to the spray mixture. Whale-oil soap has proven quite satisfactory, and when it is used an extremely even distribution of the poison is obtained.

In addition to the two insects mentioned above there are several other species of Lepidopterous larvae which attack cabbage. These include *Plutella maculipennis*, Curtis; *Caradrina exigua*, Hbn.; *Autographa precationis*, Gn., and a few species of cutworms. The cutworms can usually be controlled by using baits composed of bran poisoned with white arsenic or Paris green and sweetened with molasses or sugar. The other species mentioned are, as a rule, of minor importance. However, if they should become troublesome, they can be controlled by spraying with Paris green applied as recommended for the common cabbage worm. In fact, if an effort is made to control this latter species these other insects will be wiped out at the same time, should they be present.

There are at least two species of plant lice which, at times, seriously injure cabbage in the Islands. These are the common cabbage louse, (*Aphis brassicae*, Linn), and the green cabbage louse, (*Myzus persicae*, Sulz.). I have found it comparatively easy to control these lice by spraying thoroughly with the following solution:

"Black Leaf 40"	1 ounce
Whale-oil soap	4 ounces
Water	4 gallons

It sometimes happens that both plant lice and Lepidopterous larvae are present on cabbage at the same time. In such a case it is desirable to use a combined contact and stomach poison. In one of my experiments the following formula was used:

Paris green	3 ounces
"Black Leaf 40"	2¼ ounces
Whale-oil soap	12 ounces
Water	9 gallons

Over 400 good sized cabbage plants were sprayed very thoroughly from two sides and above with this combination. At the time of the application the plants were infested by *Myzus persicae* and an unidentified species of thrips, *Pontia rapae* larvae, of all sizes, were abundant, and there were also scattered larvae of *Plutella maculipennis*, *Caradrina exigua*, and *Autographa precationis* present. The lice and thrips and all species of the Lepidopterous larvae were promptly killed by coming in contact with the spray. The *Pontia* eggs were not damaged, but when the little larvae hatched they were killed by their first meal of the poisoned foliage. For quick results this combination excels any insecticide I have ever tested. Its killing effect on the Lepidopterous larvae is particularly worthy of note.

It will be seen from this report that truck growing in the Islands is hampered by many destructive insect pests. Fortunately, most of these insects can be controlled by simple and cheap remedies. One of the greatest needs, at present, is to induce the growers to employ these remedies intelligently.

For the future the studies of the Japanese beetle, the melon fly, and the numerous cabbage pests are projects worthy of special attention. The tests of insecticides should be continued with the idea of determining their usefulness under local conditions. The mere fact that an insecticide has proven effective on certain parts of the mainland is no guarantee that the same results will be obtained here. Under the circumstances no insecticide should be recommended until it has been thoroughly tested by an expert and, if necessary, modified sufficiently to make it effective under local conditions. If such a policy is carried out, the growers will gain confidence, and eventually truck growing will become a much more profitable industry than it is at present.

Respectfully,

H. O. MARSH,

Assistant Entomologist.

Some Experiments on the Chrysanthemum Plant Louse.

(*Macrosiphum sanborni*, Gillette.)

By H. O. MARSH, Assistant Entomologist.

During the late summer and fall of 1910 an opportunity was offered to make an economic study of *Macrosiphum sanborni*, Gillette, at Honolulu, T. H. This reddish plant louse is, at times, a serious pest on chrysanthemums, and during the past season was found infesting many plantings of chrysanthemums in commercial flower gardens and on small plantings in private gardens.

The writer arrived in Honolulu July 18, and two days later his first observations were made on this insect. At that date the lice were found on young chrysanthemum plants which were only three or four inches in height. They occurred in great numbers on the tender tips of the main stalks, on both the upper and lower surface of the terminal leaves and on the lower surface of the older leaves. On the terminal leaves and stems they were exposed to view, but the older leaves, especially those which had been infested a short time, drooped downward and the lice which infested only the lower surface were well protected.

By August 1 the lice, which were first observed July 20, had increased very noticeably. The most abundant enemy was a little bluish fly, *Leucopis nigricornis*, Egger. The larvae of this fly fed on the lice, and when mature pupated on the upper surface of the leaves. There were also occasional Scymnus and Syrphid larvae, and rarely an adult of *Coelophora inaequalis*, Fab. Shortly before the middle of September, when the plants had become badly stunted from the injury produced by the lice, the larvae of this ladybird became quite abundant in one patch of chysanthemums and considerably reduced the number of the lice. No Hymenopterous parasites were found infesting the lice at any time during the season.

It was obvious that the natural enemies were not able to gain control and that it would be necessary to reduce the lice by spraying if the plants were to be saved from serious injury. Accordingly a series of experiments were undertaken to determine the most effective insecticide to use against this species. The experiments were made in a patch of chysanthemums consisting of about forty rows of plants, each ten yards in length.

The various solutions, which were experimented with, were applied, except in Experiment 5, with a Brown compressed air sprayer, fitted with an extension rod, elbow and Mistry (Ver-

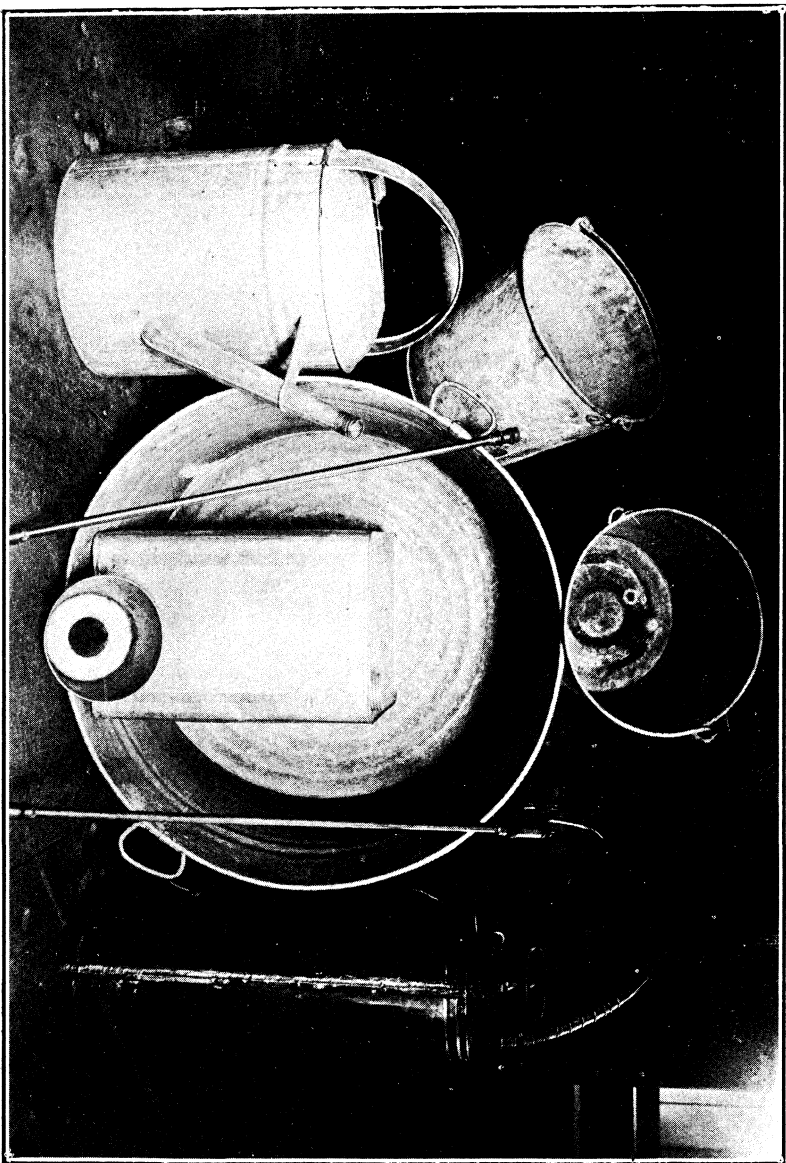


Plate 30. Spraying Equipment.

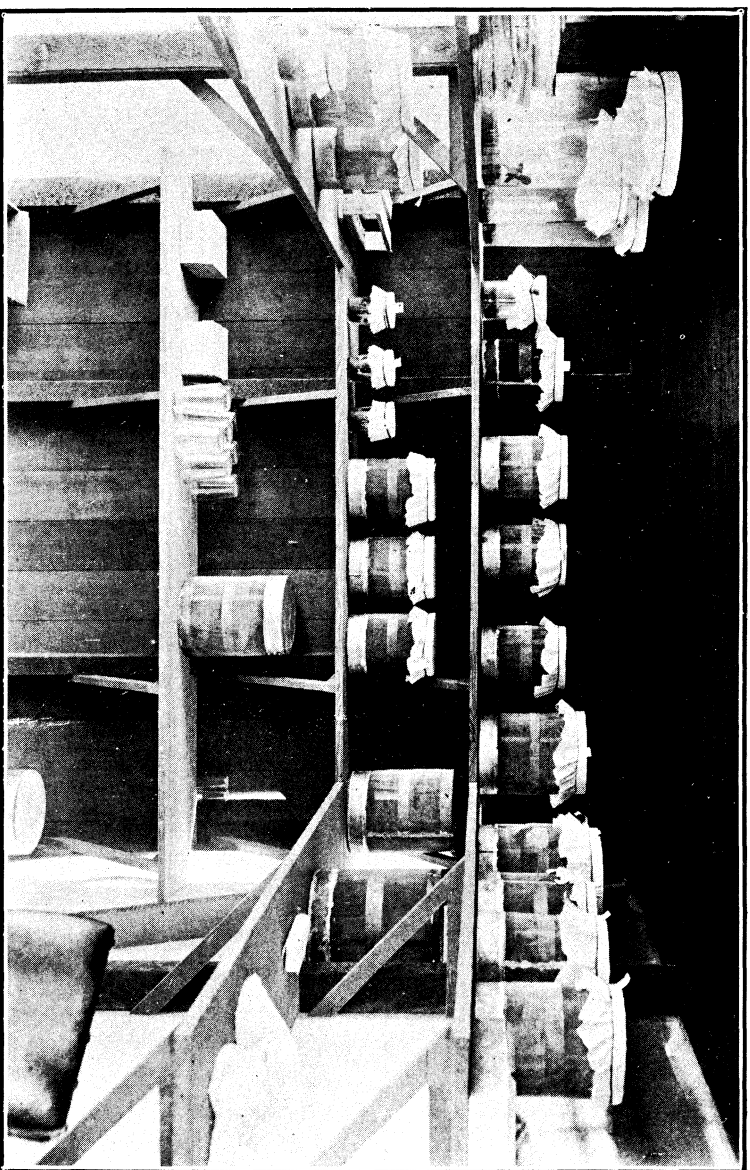


Plate 31. Interior of Insectary.

morel type) nozzle. The plants were sprayed from two sides, and a particular effort was made to reach the under surface of the old leaves. Owing to the manner in which these old leaves drooped, it was practically impossible not to miss an occasional one on the under side. Of course, wherever a leaf was missed the lice were unharmed, and within a few days spread to the uninfested portions of the plant.

In all the experiments the writer personally prepared and applied the solutions and noted the results. Owing to the frequency of the rains which occur in the vicinity of Honolulu it is very desirable to use insecticides which kill quickly. With this object in view the writer paid particular attention to the immediate effects of the various solutions which were tested in these experiments. The term "immediate effect" is intended to be construed as meaning the apparent action of the solutions upon the lice within five to fifteen minutes after the application and while the plants treated were still wet. The weather conditions, except for frequent rains, were favorable during the time the experiments were under way.

As noted above, the most abundant natural enemy was *Leucopis nigricornis*. The larvae and pupae of this little fly were uninjured by any of the solutions, except whale-oil soap, as used in Experiment 9. This was proved by watching the larvae in the field and by collecting the pupae from the leaves immediately after they were sprayed, and while still wet from the applications, and keeping them in cages in the insectary until the adults issued.

Eight rows of plants were left unsprayed as checks. These plants were scattered in various parts of the patch, and long before the end of the season they were very badly damaged, although none were actually killed. The injury produced by the lice stunted the plants, and early in the season the foliage became yellow and sickly and many of the leaves were coated with honey dew and smut fungus. Other features which particularly distinguished the check plants were the remarkably small leaves, and, later in the season, the small, knotty blossom buds.

The insect enemies, although they had an opportunity to concentrate their forces on the check rows, failed to materially reduce the infestation, and it was not until past the middle of September that the lice were brought under control by natural means.

During the latter part of this month there was a period of "kona" or south winds, and the weather was hot and excessively humid, with frequent rains. These climatic conditions favored the development of fungous diseases, and nearly all of the lice on the chrysanthemums, in the patches about Honolulu, died from a disease which was identified by Mr. L. D. Larsen of the Hawaiian Sugar Planters' Station as probably an *Acontium* sp. Mr.

Larsen also made a series of laboratory experiments and was able to definitely prove that this fungous disease had caused the death of the lice.

Although almost completely freed from lice, the check plants had been so badly injured that they never fully recovered, and remained stunted and came into blossom two weeks later than the plants which were sprayed in Experiment 7.

EXPERIMENTS WITH REMEDIES.

The experiments were as follows:

Experiment No. 1.—“Black Leaf 40” 1 ounce, and whale-oil soap 8 ounces in 5 gallons of water.

August 2, 8 rows were sprayed with $2\frac{1}{2}$ gallons of this solution. It adhered to the lice and the foliage perfectly, and there was no tendency toward forming in large drops and running off the plants. The immediate effect on the lice was very good. Many of the young lice died as soon as the spray wet them, but some of the older specimens were more resistant. At the time of the application the weather was cool and cloudy. The solution was applied at about 10 a. m., and was followed within a few minutes by a heavy shower. At 1 p. m. the plants were examined and it was evident that the rain had not lessened the killing effect of the application.

Frequent rains occurred during the following two days, and August 5 it was noted that the few lice which survived the spraying were breeding rapidly. August 12 some of the tips and terminal leaves were fairly well infested, although the plants were still in fine, healthy condition and growing nicely. August 18 many of the tips had become rather badly infested and the experiment was closed on this date. On the whole, this solution gave fairly satisfactory results; its chief fault being that it did not kill all of the old lice with which it came in contact.

Experiment No. 2.—“Spra-Mulsion” 1 pint in 5 gallons of water.

August 2, 2 rows were sprayed with $\frac{1}{2}$ gallon of this emulsion. It did not adhere well and collected in large drops and ran off the foliage. It was the writer's intention to spray eight rows with this emulsion, but immediately after the application was made on two rows some of the older leaves become spotted on the upper surface, and it was evident that it would not be safe to continue the experiment. This spotting or burning occurred in large, irregular areas on part of the leaves. The injured leaves appeared as though they had been crushed. Later these

spots became dry and brown, and somewhat disfigured the plants, but no extensive damage resulted. It was curious to note that the injury was confined to the older foliage, while the tender, terminal leaves were uninjured. The immediate effect of the emulsion on the lice was very poor; very few were killed even where they were drenched by the spray.

The weather at the time of the application was cool and cloudy and a shower occurred shortly after the spraying was finished.

August 3 most of the lice were alive, and it was plain that the application was a failure. August 8 the plants were just as badly infested as the checks, and the experiment was closed on this date. It may be possible that the rain which quickly followed the application of this emulsion lessened its killing effect on the lice somewhat, but as it also failed in other ways it can not be considered worthy of further trial on tender plants.

Experiment No. 3.—Whale-oil soap 1 pound in 5 gallons of water.

August 5, 4 rows were sprayed with 1 gallon of this solution. The application was made while the water in which the soap was dissolved was still warm. The solution adhered to the lice and foliage perfectly, but the immediate effect was not good, and many of the lice which were thoroughly drenched were not killed. At the time of the application the weather was cool and cloudy, but no rain followed in time to interfere with the results.

August 6 it was evident that this treatment was a failure, as only a moderate number of the lice were dead. August 12 the plants were just as badly infested as ones which had not been sprayed, and the experiment was discontinued.

Experiment No. 4.—“Black Leaf 40” $1\frac{1}{4}$ ounce in 5 gallons of water.

August 5, 4 rows were sprayed with 1 gallon of this solution. It had a tendency to run together in drops and did not adhere well to the foliage or the bodies of the lice. The immediate effect did not seem promising. At the time of the application the weather was cool and cloudy.

August 6 it was noted that a fairly large proportion of the lice were dead, but on the whole the results were not particularly good. August 12 many of the plants were well infested, and by August 18 the infestation had become very bad, and the experiment was closed on this date.

The almost complete failure of this experiment, in which “Black Leaf 40” was used alone, strongly emphasizes the necessity of adding some sticky agent to the solution.

Experiment No. 5.—“Black Leaf” 10 ounces, and whale-oil soap 8 ounces, in 5 gallons of water.

August 7, 8 small chrysanthemum plants were sprayed with 2 ounces of this solution. This was intended simply as a preliminary test to determine the effect of the solution on the foliage, and the application was made with an atomizer.

The immediate effect on the lice seemed to be fairly good. Most of the young appeared to die as soon as the solution covered them, but many of the older specimens were not killed. The weather at the time of the application was bright and fairly cool, with a light breeze.

August 9 the results of the test did not seem particularly good, as there were plenty of live, mature lice on the plants. The margins of the terminal leaves showed some slight burning, but no real damage resulted. By August 12 the plants were rapidly becoming reinfested, and August 18 they were so badly infested that the test was obviously a failure and was discontinued.

The very poor results of this test were due largely, if not entirely, to the fact that the application was made with an atomizer. The atomizer gave a very light, fog-like spray which wet the lice thoroughly, but did not penetrate as well as if the solution had been applied at greater pressure. This failure particularly emphasizes the necessity of applying insecticides at good pressure.

Experiment No. 6.—“Black Leaf” 10 ounces and whale-oil soap 4 ounces in 5 gallons of water.

August 8, 8 rows were sprayed with $2\frac{1}{2}$ gallons of this solution. It adhered very well to the lice and the foliage and did not run together in drops.

The immediate effect on the lice appeared to be good. The young apparently died as soon as they came in contact with the solution, but the older specimens were more resistant. The weather at the time of the application was cool and clear, with a light breeze.

The following day most of the young lice and a large proportion of the old ones were dead. The margins of the tender, terminal leaves showed some burning, but it was so slight that no actual damage resulted. August 18 the plants were still quite free from lice except that some of the tips and terminal leaves were more or less infested. The lice increased rapidly, and August 23 it was evident that respraying would soon be necessary. August 30 the plants were in good, vigorous condition, but the infestation was so bad that respraying could not be safely delayed any longer, and the experiment was closed on this date.

On the whole this solution was satisfactory, and, although “Black Leaf 40” gave comparatively even better results, it can be highly recommended.

Experiment No. 7.—“Black Leaf 40” $1\frac{1}{4}$ ounce and whale-oil soap 4 ounces in 5 gallons of water.

August 8, 8 rows were sprayed with $2\frac{1}{2}$ gallons of this solution. Six of the rows were sprayed from both sides, but owing to the supply of material being exhausted the last 2 rows were sprayed from one side only. The solution adhered to the foliage and to the bodies of the lice just about as well as in other experiments where double the amount of soap was used. The immediate effect of the solution was excellent, as a very large proportion of the lice apparently died almost as soon as they came in contact with the spray. The weather at the time of the application was cool and clear, with a light breeze.

When the plants were examined the following day, all the young lice and almost all the old ones, on the 6 thoroughly sprayed rows, were dead. The results were not quite so good on the 2 rows which were sprayed only from one side.

August 18 the plants were still very free from lice and in excellent healthy condition. At this date 17 additional rows, which had previously been sprayed in Experiment Nos. 1, 4, 5, 8 and 9, were resprayed with 10 gallons of this solution.

Examination made the following day showed that the results of this application were about as nearly perfect as could be desired. All the lice were dead with the exception of specimens which occurred on the underside of an occasional leaf which had been missed by the spray.

August 23 it was noted that, as a whole, the plants which had been sprayed with this solution were very free from lice, although some of the tips and terminal leaves of the plants sprayed August 8 were becoming reinfested. As noted elsewhere, there were 8 check rows. These were very badly infested, and the lice were spreading from them to the sprayed plants.

By August 30 the 2 rows which were sprayed on one side August 8 were fairly well infested. At this date these 2 rows, 6 of the check rows, and the 8 rows, which had previously been sprayed in Experiment 6, were sprayed with 10 gallons of this solution. The results of this application were excellent and left little to be desired.

September 6 the 6 rows which were thoroughly sprayed August 8 had become sufficiently infested to make respraying necessary. Some of the plants which were sprayed August 18, in this experiment, which adjoined the check rows, had also become somewhat infested. Accordingly the 6 rows which were first sprayed August 8 were very thoroughly resprayed and parts of the rows which adjoined the check rows were “touched up” on this date. This “touching up” simply consisted in lightly spraying the worst infested tips, and no attempt was made to make a

thorough application. In all 10 gallons of the solution were used; about 6 being applied on the 6 rows and the rest was used in touching up the other plants as noted. During the following twenty-four hours there were frequent showers, but the results of the application were excellent as usual.

September 14 it was noted that the plants were in fine, vigorous condition, although a few tips were slightly infested. Following this date and continuing through the latter part of September there was a period of excessively humid weather with heavy showers and heavy dews. This weather favored the growth of fungous diseases, and during the last two weeks of the month nearly all of the lice died. During October the weather was cool and comparatively dry, and the few surviving lice had an opportunity to multiply, but they did not increase sufficiently to make another spraying necessary.

The majority of the plants sprayed in this experiment came into bloom about the middle of October, and at that time the large, stocky plants and the profusion of perfect blossoms formed a striking contrast to the stunted and still blossomless plants in the check rows.

Experiment No. 8.—“Black Leaf 40” $1\frac{1}{4}$ ounce and molasses 1 quart, in 5 gallons of water.

August 9, 2 rows were sprayed with $1\frac{1}{4}$ gallon of this solution. The spray did not adhere to the lice nor to the foliage as well as if soap had been used in place of the molasses. The immediate effect of the treatment did not appear particularly promising. The weather at the time of the application was cool and clear, with a light breeze.

August 10 the results appeared to be fairly good. Most of the young lice and many of the mature ones were dead, but there were still plenty of live specimens present. August 12 it was noted that the plants were fairly free from lice, but the results, as a whole, were not nearly so good as in other experiments in which soap had been used as an adherent instead of molasses. August 18 many of the tips and terminal leaves were infested. In general the infestation was not very severe, but it was bad enough to make respraying, with a more effective material, desirable, and the experiment was accordingly closed on this date.

It is necessary, if the best results are to be obtained from the use of “Black Leaf 40,” to add some adhesive agent to the solution. Whale-oil soap has proven excellent for this purpose, but in this experiment, molasses, which can be obtained as a refuse product from the sugar mills, was used in hopes that, if equally effective, it would prove cheaper than soap. The molasses failed, however, to help the spray to adhere to the bodies of the lice,

and for this reason it cannot be recommended as a substitute for whale-oil soap. In later experiments which the writer made on another species of plant louse the amount of molasses was doubled, but the solution still failed to adhere to the lice, although it did adhere to the foliage very well.

Experiment No. 9.—Whale-oil soap 1 pound in 3 gallons of water.

August 9, 3 rows were sprayed with $1\frac{1}{2}$ gallon of this solution. The application was made while the water in which the soap was dissolved was still warm. The solution adhered to the lice and foliage perfectly, but the immediate results were only moderately good. The weather at the time of the application was cool and clear, with a light breeze.

Examination the following day showed that some of the young lice and many of the mature ones were still alive. A large proportion of the *Leucopis* larvae were dead, and the margins of some of the tender, terminal leaves were burned. No serious damage resulted from this burning, however.

August 12 it was very evident that this treatment was not satisfactory, as many of the tips and terminal leaves were badly infested. By August 18 the infestation had become very bad, and the experiment was closed on this date.

The soap, as used in this experiment, killed some of the young lice, but the results on the whole were so poor that it cannot be recommended. Whale-oil soap is considered a standard remedy for many species of plant lice. Judging from the complete manner in which it failed in Experiments 3 and 9, it is evident that *Macrosiphum sanborni* is an unusually resistant species.

SUMMARY OF EXPERIMENTS.

These experiments may be summarized as follows:

Experiment No.	Date.	Insecticide used.	Results.	Injury to plants.	Remarks.
4	1910 Aug. 5	"Black Leaf 40" 1 1/4 ounce in 5 gallons of water.	Poor	None	Some adhesive is necessary to enable the spray to adhere to the lice and foliage.
8	Aug. 9	"Black Leaf 40" 1 1/4 ounce and molasses 1 quart in 5 gallons of water.	Only moderately good	do	The spray failed to adhere to the lice although it adhered to the foliage fairly well.
1	Aug. 2	"Black Leaf 40" 1 ounce and whale-oil soap 8 ounces in 5 gallons of water.	Very good	do	More "Black Leaf 40" and less whale-oil soap should have been used.
7	Aug. 8	"Black Leaf 40" 1 1/4 ounce and whale-oil soap 4 ounces in 5 gallons of water.	Practically perfect	do	The application should be repeated at intervals of three or four weeks.
5	Aug. 7	"Black Leaf" 10 ounces and whale-oil soap 8 ounces in 5 gallons of water.	Very poor	do	The solution was applied with an atomizer which accounts for the poor results.
6	Aug. 8	"Black Leaf" 10 ounces and whale-oil soap 4 ounces in 5 gallons of water.	Very good	None worth mentioning	Application made at good pressure with a sprayer.
3	Aug. 5	Whale-oil soap 1 pound in 5 gallons of water.	Entirely ineffective	None	Injury to foliage not permanent.
9	Aug. 9	Whale-oil soap 1 pound in 3 gallons of water.	Ineffective	Very slight	A few leaves were killed but no serious injury resulted.
2	Aug. 2	"Spray Mulston" 1 pint in 5 gallons of water.	Entirely ineffective	Slight	



Plate 32. Photo taken October 21, 1910, showing check plants (Chrysanthemums) and portion sprayed in Experiment 7.

APPARATUS AND INSECTICIDES USED.

As noted elsewhere, the equipment used in all of these experiments, except No. 5, consisted of a Brown compressed air sprayer fitted with an extension rod, elbow and a Mistry (Vermorel type) nozzle. This sprayer has a capacity of three gallons, and can be easily carried, when slung by a strap across one shoulder. As ordinarily sold, it is supplied with a short length of hose, and in order to do effective work it is necessary to purchase an extra 23-inch extension rod and an elbow. The elbow is required when spraying the under surface of the foliage on low-growing plants. Unfortunately, the nozzle which is supplied by the manufacturers with this sprayer delivers a rather coarse spray, and to do the most effective work the writer has always found it necessary to replace this nozzle with one of the Vermorel type, which also has to be purchased as an extra. This sprayer has no agitator, but this is not a serious fault when such solutions as tested in these experiments are used. The solutions, if properly prepared, require very little agitation, but if mixtures of Paris green or arsenate of lead are used it is necessary to shake the sprayer frequently to keep the poison in suspension. When spraying for leaf-eating insects on rose bushes, the writer has applied arsenate of lead at the rate of 15 pounds in 100 gallons of water with one of these sprayers, and by shaking the tank from time to time no difficulty was experienced in keeping the poison in suspension.

When using a sprayer of this type, it is best to fill the tank about two-thirds full and then pump air into the remaining space until a good, stiff pressure is obtained. The higher the pressure the better the results will be from the spraying. This point is very important and particular care should be taken to keep up a good pressure by frequent pumping.

This sprayer, when supplied with the additional fittings as noted above, is excellent for use in vegetable and flower gardens and for spraying various small plants and shrubs. Under ordinary conditions it would more than repay its cost in a single season. The complete outfit can be purchased locally for about ten dollars.

The insecticides used in these experiments consisted of "Black Leaf 40," "Black Leaf," "Spra-Mulsion," and whale-oil soap.

"Black Leaf 40" and "Black Leaf" are liquid nicotine preparations manufactured by the Kentucky Tobacco Product Company of Louisville, Ky. "Black Leaf 40" is a concentrated solution of nicotine sulphate. It is lighter, less bulky and mixes more readily with water than "Black Leaf," and although either preparation is effective against plant lice when applied at the proper strength, the writer considers the former the more serviceable of the two. One feature which makes these prepara-

tions particularly valuable is the prompt killing effect they have on the insects treated. Either preparation may be used safely on almost any ordinarily resistant foliage without danger. The addition of whale-oil soap seems to intensify the action of the solution both on the insects and on the foliage. Occasionally some scalding will result and is most likely to occur if the weather is clear and hot at the time the application is made. In the author's experience the scalding has invariably been more severe with "Black Leaf" than with "Black Leaf 40," but, although he has used many gallons of both solutions, on a variety of plants, he has never witnessed any serious or permanent injury.

In addition to *Macrosiphum sanborni*, the writer has successfully controlled several other species of plant lice, mealy bugs and thrips with "Black Leaf 40" when used in combination with whale-oil soap, as in Experiment No. 7. "Black Leaf 40" is listed by the manufacturers at \$12.50 for a 10½-pound can. When diluted as in Experiment No. 7, this quantity would make about 500 gallons of solution.

"Black Leaf" is not concentrated, and when used so as to obtain an effective strength its cost is practically the same as "Black Leaf 40."

"Spra-Mulsion" is a miscible oil manufactured by the R. R. Rogers Chemical Company of San Francisco, Cal. When diluted with cold water, it forms a perfect emulsion which remains stable apparently indefinitely. When used at a 1 to 40 dilution, as in Experiment 2, it proved entirely ineffective against *Macrosiphum sanborni* on chrysanthemums. It also failed to adhere well and injured the foliage so that it could not be safely used at a greater strength.

Whale-oil soap is too well known to require any description. It can be purchased at almost any drug store, and locally costs about ten cents per pound. When obtained in bulk, from the manufacturers, the cost is considerably less.

The Brown sprayer, with all necessary extras, "Black Leaf 40," whale-oil soap, and various other insecticides, can be purchased in Honolulu from Messrs. E. O. Hall & Son.

GENERAL DIRECTIONS FOR SPRAYING.

In preparing solutions or mixtures for spraying it is absolutely necessary to carefully weigh or measure the ingredients and the proportions should be exactly as recommended. It is necessary to have a reliable scale and a graduate or other accurate measure. An ordinary tablespoon holds ½ ounce of liquid, and if a graduate is not available such a spoon may be used for measuring "Black Leaf 40" or other liquid insecticides.

When preparing whale-oil soap, it should be shaved into small strips and dissolved in hot water. It can be dissolved in cold water, but hot water will give much quicker and more satisfactory results.

After the ingredients are carefully weighed or measured, they can be mixed, with the required amount of clean, cold water, in a wash tub or barrel. For quantities not exceeding five gallons the writer has found a large watering can to be a very convenient receptacle in which to mix the solutions. Care should be observed that a perfect combination of the insecticide and water is obtained, and to get this result some stirring will be necessary. After a perfect combination is secured the solution should be strained into the sprayer tank in such quantities as may be desired. It is absolutely necessary to use a strainer of some kind, otherwise bits of dirt, leaves or other material, which it is practically impossible to prevent from falling into the solution, will get into the sprayer and clog the nozzle. If nothing better is at hand, a piece of cheese cloth may be used, but it is much more satisfactory to have a metal strainer with a fine mesh.

It is better not to prepare a larger quantity of solution than is actually needed for prompt use. Solutions allowed to stand in open receptacles over night or from day to day are very likely to deteriorate in quality.

After the solution is prepared and strained it should be applied at good pressure as a fine, forceful spray through a nozzle of the Vermorel type. Every portion of the plant, above ground, including both the upper and lower surface of the leaves, should be thoroughly wet by the spray. In spraying for plant lice or other sucking insects it should always be borne in mind that a contact insecticide is being used and that unless the insects are actually thoroughly wet by the spray they will not be killed.

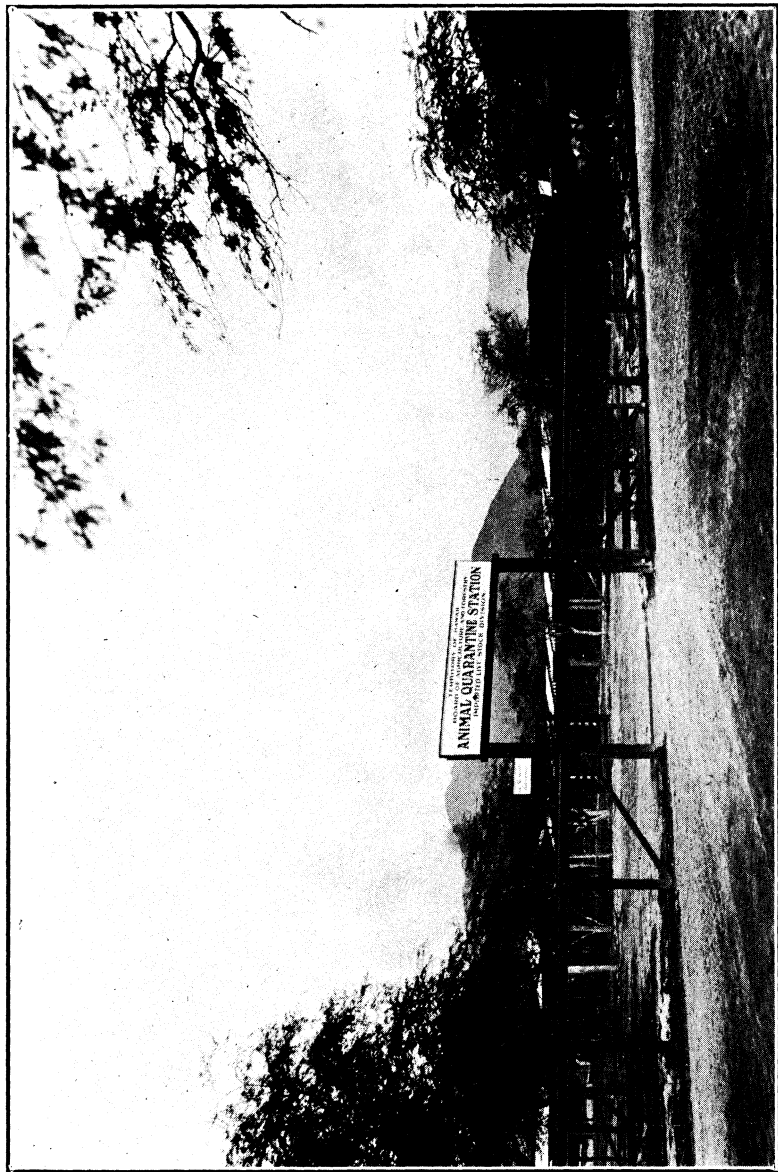
The necessity of thorough work cannot be too strongly emphasized. Plenty of the spray should be applied to every plant, as it is very poor economy to attempt to be saving in the amount used. It will pay to repeatedly examine the under surface of the leaves during the course of the application to determine if they have been reached, and if not thoroughly wet they should be re-sprayed at once.

As a general rule it is safer to apply insecticides during the cooler portions of the day and thus avoid the danger of scalding tender foliage.

After the application is completed the sprayer should be thoroughly washed with clean water and the valves oiled.

REMEDY RECOMMENDED.

If chrysanthemums are found to be infested by plant lice, spray promptly and thoroughly with "Black Leaf 40" and whale-oil soap as used in Experiment 7. Should the infestation commence early in the season, while the plants are still small, two or three applications will be required at intervals of three or four weeks, and if the directions given in this paper are carefully followed the lice can be easily and cheaply controlled.



New Animal Quarantine Station, Beach Road, Honolulu.

Division of Animal Industry.

LETTER OF SUBMITTAL.

Honolulu, Hawaii, December 31, 1910.

The Honorable Board of Commissioners of
Agriculture and Forestry,
Honolulu, T. H.

Gentlemen:—I have the honor to submit herewith the biennial report of the Division of Animal Industry, covering the work of this Division from July 1st, 1909, to December 31st, 1910.

As the funds from which the Board of Agriculture and Forestry has derived its support during the past period were obtained from that part of the "Special Income Tax" which was set apart for "Conservation" it may not be amiss here to quote a sentence or two as to why the work of the animal industry division of this Board should at all be classified with "Conservation" and how the veterinarian can be a factor in this worthy cause.

Dr. A. D. Melvin, Chief of the Federal Bureau of Animal Industry, in his address as President of the American Veterinary Medical Association, before the annual meeting of that body in San Francisco during September last year stated: "The value of the work of the veterinary profession, while better appreciated now than formerly, is not yet generally realized. This work promotes the conservation of our domestic animals, which means the conservation of a very important part of the food supply of the people, and in turn the conservation of human health and life, which after all is the acme of conservation. As has been truly stated by a prominent citizen of this State (California), the conservation of food comes before morals or religion. Viewed in this light, the work of the veterinarian is not only of great economic value; it is something still higher; it is an important agency for human welfare."

In this connection I take special pleasure in calling attention to the appended reports of the several Deputy Territorial Veterinarians from which it will appear that the conservation of our domestic animals as food producers has here, for the first time, been given serious consideration as part of the work of the Board of Agriculture and Forestry.

With the eradication of bovine tuberculosis from the dairy herds and beef cattle of the islands, as inaugurated in the City and County of Honolulu and supported by the Deputies in charge of the other districts it is needless to emphasize the work of the Division of Animal Industry as an important factor in the promotion of human welfare.

Very respectfully,

VICTOR A. NORGAARD,
Territorial Veterinarian.

Report of the Territorial Veterinarian.

BY VICTOR A. NORGAARD V. S. (Copenhagen).

INTRODUCTION.

The principal objects of this Division may be divided into three, all of which lead to the same end, that is, the development of the live stock industry of the Territory, as follows: (1) Measures to prevent the introduction of infectious and contagious diseases, (2) Measures to control, suppress and eradicate such diseases as have already gained a foothold here, and (3) the investigation of diseases of whatever nature which are or may become of economic importance to the live stock industry of the Territory, as well as to the public health in general.

For the purpose of attaining this end a number of laws have been enacted by the last three legislatures (the Division of Animal Industry dates back less than six years) and supported by these laws a number of rules and regulations have been promulgated and amended as required by conditions and exigencies, till it may safely be asserted that no state or territory in the Union is better protected in so far as its live stock and related industries are concerned, as is the Territory of Hawaii. That this result has been obtained in such a short space of time is to a great extent due to the unique position of the Islands, which makes it possible to guard all ports of entrance through which infection might reasonably be expected to come in—and, furthermore, to the unstinted aid which this Board has received from the Federal Bureau of Animal Industry, in its efforts to prevent the further introduction of deleterious diseases as well as in the eradication of diseases already here, as for instance tuberculosis.

RULES AND REGULATIONS.

During the past period the rules and regulations of the Division of Animal Industry have been completely revised and a new edition issued, which took effect on Jan. 1st, 1910. No radical deviation from the policy previously followed by the Board was resorted to, with one exception. The rule which imposes a three weeks' quarantine on all horse stock coming from or through the State of California was amended so as to make it compulsory for such stock to be confined during the quarantine period on premises provided by the Territorial Government, while previously the owner had been permitted to provide or use his own premises, if upon inspection they were found to be satisfactory to the Board. This latter arrangement, which had been necessitated by the lack

of a suitable quarantine station, had proven highly unsatisfactory, and the system must of necessity be considered a provisional or makeshift quarantine at best, and dependent upon the owners' inclinations or desires for its effectiveness. The Board therefore decided, when the "Conservation Act" was passed, to authorize the building of a modern animal quarantine station.

NEW ANIMAL QUARANTINE STATION.

After many premises and localities had been considered a suitable location was found on the Ala Moana Road, at once convenient to the office of the territorial veterinarian and at the same time approachable from the entire waterfront. With no buildings or dwellings within 1,000 feet, with perfect drainage through a sandy soil with coral foundation, with a good growth of algaroba trees for shade, the location comes close to being perfect for an animal quarantine station. A lease was obtained on a practically level piece of this land, containing 3 acres, with a frontage of 265 feet on the Beach Road. This piece of land was enclosed with 4-foot woven wire "Page" fence, and subdivided into a glanders division, a hog cholera division,—both of which are enclosed with solid board fences 7 feet high,—and a detention division consisting of ten paddocks of varying sizes, accommodating as many as 30 head of horses or mules each. These paddocks are separated from each other, as well as from the outer fence, by 20' alleyways, and the 10' gates are so arranged, wherever possible, as to meet when open, thereby forming a barrier across the alley. Each paddock is provided with a central feed rack and shelter (see accompanying illustrations), consisting of a corrugated iron roof, 20' wide, sloping from the middle toward the edges, and of varying lengths, in proportion to the size of the paddock. Under the roof, and at an appropriate distance from the ground, is the hay rack, braced on the main uprights, which are made of 6"x8" sawed redwood posts. Under the hay rack and slightly elevated above the ground is a feed box, running the full length of the shelter. Two of the larger paddocks are provided with five box stalls each, intended for stallions, jacks or race horses, the paddock serving as an exercising yard for one at the time. Individual feed rooms are provided at convenient intervals.

The glanders division is, as stated, completely separated from the detention or quarantine division, and serves for the immediate segregation of any animal showing symptoms of a suspicious nature. It contains a chute for the testing, treating or confining for examination of fractious animals, and is provided with six isolation stalls. This division opens directly on the

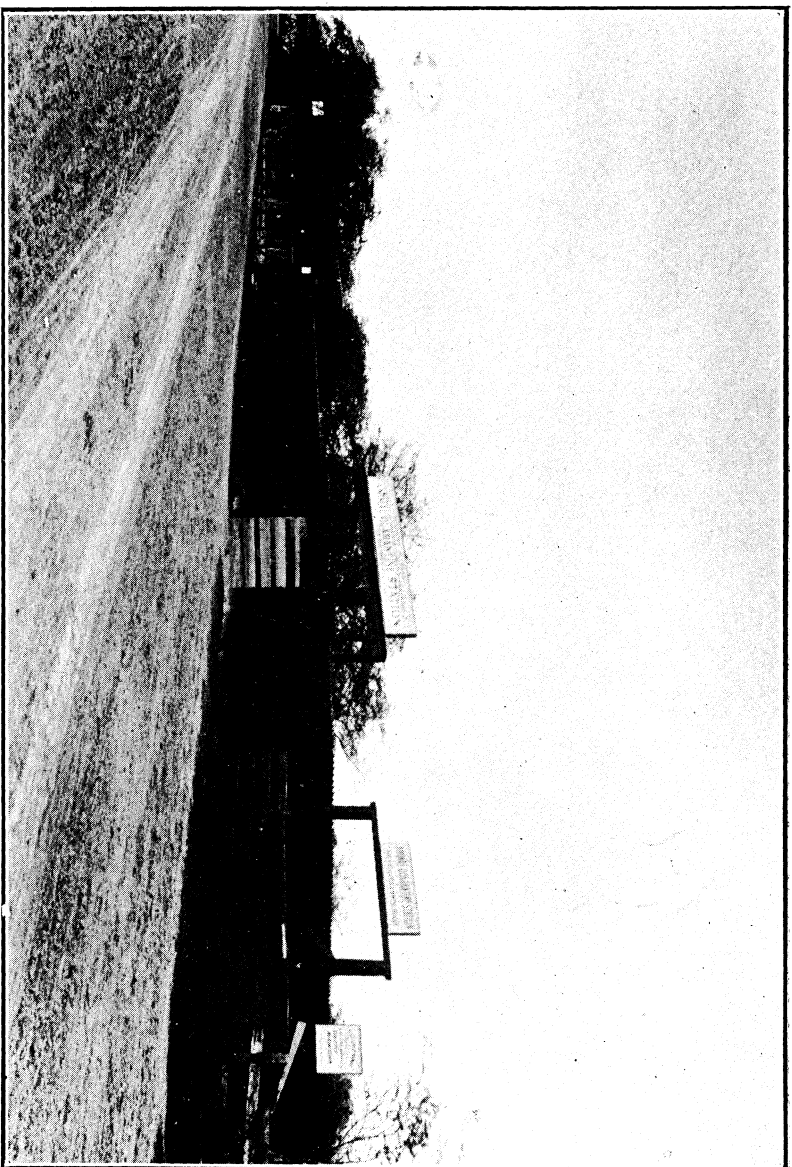


Plate 33. New Animal Quarantine Station on Beach Road.
Honolulu.

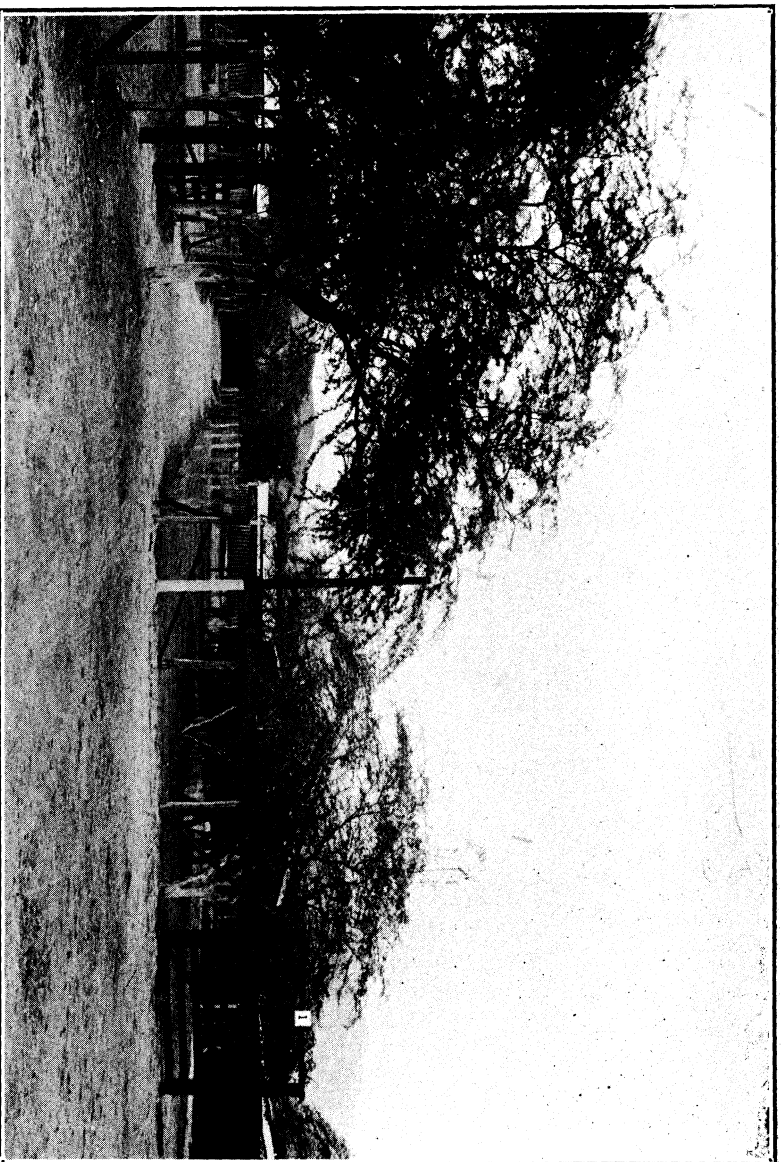


Plate 34. New Animal Quarantine Station; Main Alley.



Plate 35. Glanders Division of New Quarantine Station.

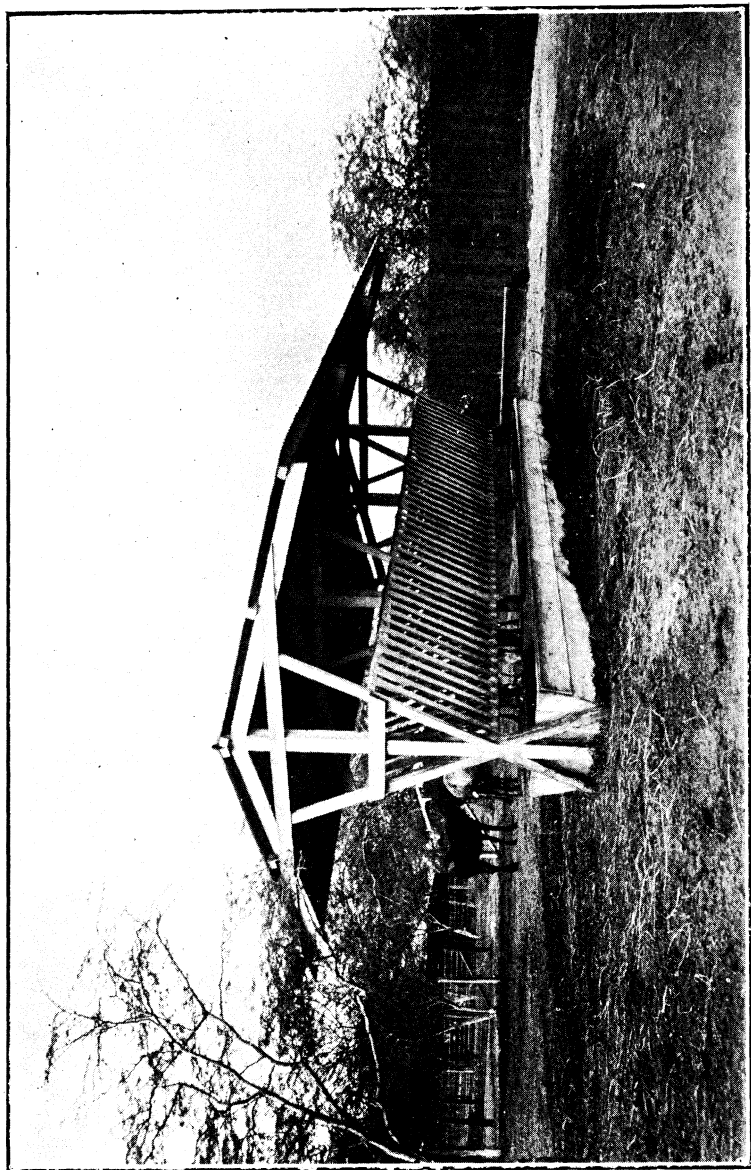


Plate 36. Shelter and Feed Rack, New Quarantine Station.

Beach Road by large sliding doors through which a herd of cattle or a bunch of horses may be introduced and kept confined for testing or treatment without coming in contact with suspicious cases which may happen to be in the stalls. The only connection between the glanders division and the detention division is through the office or laboratory, which also opens on the Beach Road, and where medicines, instruments and record books are

The hog cholera division is also, or at least partly, enclosed by a solid board fence, seven feet high, and is divided into four sections, one of which, when finished, will contain a small abattoir for the proper butchering of exposed but unaffected animals.

The station has so far been found large enough to accommodate all the animals requiring quarantine at one time, but if more than two steamers carrying a full consignment of live stock should arrive within two weeks of each other the quarters might be found insufficient. This exigency is, however, not likely to occur.

Since the station was taken in use on Sept. 25, 1909, it has at one time or another harbored the following numbers and kind of animals:

SIMPLE QUARANTINE.

Horses, 233; Mules, 477; Jacks, 3; Bulls, 50; Heifers, 30; Rams, 100. Total, 893.

INFECTIOUS DISEASES.

Glanders: Horses, 19; Mule, 1. Tuberculosis: 1 cow.

While the station has been found a great improvement over the old Kalihi station, so great in fact, that many owners have requested permission to place imported stock there, for observation or treatment, even when the regulations did not require or impose quarantine on them, experience has shown that additions could be made to great advantage, such as a restraining chute or squeezer. When dealing with unbroken horses or mules it is often found very difficult to replace the shipping halters when the quarantine is over and it has frequently become necessary to transfer a large bunch of animals from the detention division to the glanders division in order to use the chute there for this purpose. A chute in the detention division is therefore a necessity that must be provided for sooner or later.

A cottage for the keeper will also have to be built as the keeper must be on the premises at all times, and the present arrangement, where he lives in a shack adjoining the station and which he may have to vacate at any time, is highly unsatisfactory.

QUARANTINE STATION IN HILO.

The animal quarantine station which was provided for Hilo about 3 years ago has proven entirely inadequate and negotiations are now under way for the acquiring by this Board of the unexpired lease of the old race track grounds outside of Hilo and which can be made into a very suitable and convenient station at a reasonable cost. The race track grounds are the only suitable location in or in the neighborhood of Hilo where a satisfactory station could be built. The lease is now held by the Volcano Stables and Transportation Co., who some time ago offered to relinquish the remaining term of lease, 8 years, for the sum of \$2500. A bill providing for this transfer, which is absolutely essential, will be presented to the coming legislature, and it is sincerely hoped that adequate provision will be made both for the transfer of the lease and for the construction of suitable quarters, stables and enclosures. The urgent need for this will be found fully explained in the appended report of the Deputy Territorial Veterinarian for the Hilo district (see p. 210). The importation of mules through the port of Hilo frequently exceeds the number arriving through Honolulu, and our experience during the past six years has shown definitely that horse stock coming from or through California must be quarantined here if serious consequences are to be avoided.

The provision of territorial quarantine stations on the Islands of Maui and Kauai, as recommended by the respective Deputy Territorial Veterinarians in their appended reports, would not seem to be urgently required so long as all horse stock imported directly for these islands must come to Honolulu first.

IMPORTATION OF LIVE STOCK.

The following live stock has been received through the ports of Honolulu and Hilo, respectively, during the period of 1909-1910:

	Horses	Mules	Cattle	Sheep	Swine	Dogs	Poultry (crates)
Honolulu, 1909	674	408	167	194	959	72	267
“ 1910	543	445	189	120	21	117	421
Hilo 1909	15	153	29		116	1	89
“ 1910	26	183	4			1	57

Horses.—By far the greater number of the horses, in fact around 1000 head, belonged to the various branches of the U. S. War Department. These animals arrived here accompanied by the required mallein test certificates, and are in constant charge of the veterinarians of the army. They are taken upon arrival direct from the steamer to the quartermaster's corral in Iwilei, where they are held segregated for the required quarantine period, when they are distributed to the various regiments or depots. No question of authority in regard to the sanitary supervision of these animals has ever been raised, and probably never will be the federal authorities being as anxious to keep disease from their animals as are the territorial, and a true spirit of courtesy and coöperation has always characterized the dealings between these two branches of the government.

A few good stallions, among which must be mentioned some blue ribbon winners of German Coach and Percheron stallions, besides a number of ranged out thoroughbred stallions from California will do their share toward the improvement of the various types which are being bred here.

A shipment of mares, which were brought in here for breeding purposes during the latter part of 1910 deserves special mention, that it may serve as a warning to other horse or mule breeders, who are inclined to think that the mare is of minor importance in the production of a colt, so long that the stallion or jack is of good quality. A certain ranch company placed an order in San Francisco for 75 mares and 2 jacks, the mares to cost \$75 per head and the jacks \$1200 each. No exact specifications, or at least written agreement, were made. At any rate, there seems to have been some misunderstanding and the result was that an attempt was made to fill the order with broken down city mares and cripples, unfit for work of any kind.

The shipment, consisting of 64 mares and two jacks, arrived in Honolulu on the S. S. Hiloniar on Oct. 16th. In spite of a very pleasant trip, with no rough weather and no sickness among the animals, nine of them died en route, simply from weakness and exposure. A veterinarian, who happened to be on board, stated that at one time more than thirty animals were down, and as soon as one was gotten up another would go down, and so on until nine had to be thrown overboard, dead.

A majority of those which arrived here alive were barely able to cover the mile and a half between the place of landing and the quarantine station. One animal was found upon arrival to suffer from pneumonia and had to be shot. A number laid down immediately after reaching the station, most of them never to get up again, and when it was found that a majority of the con-

signment could masticate nothing but bran mash, the downers were put out of misery without delay.

The accompanying pictures taken about 2 weeks after arrival, give but a faint idea of what the animals looked like at the time of landing, and it is safe to predict that had the "Hilonian" met with rough weather on the voyage from San Francisco to Honolulu, not more than a dozen would have arrived here alive. As the survivors with very few exceptions, were absolutely unfit for breeding purposes, less than half a dozen were range mares, they were sold at public auction, realizing for the owners a fraction of what had been paid for them upon delivery in San Francisco.

As no infectious or contagious diseases prevailed among them upon arrival, and as the Revised Statutes of the Territory (1905), and subsequent Session Laws (1905, 1907, 1909), contain no cruelty-to-animals regulation which would be at all applicable or effective in dealing with the case, the survivors had to be admitted to the Territory, and the owners left to obtain recourse through the courts. The case illustrates however the urgent necessity for legislation against cruelty to animals and the fallacy of attempting to ship old and decrepit animals from San Francisco to Honolulu, unless special provision is made for caring for them and feeding them on the way. That aged city mares, which have been grain fed their entire life, cannot serve as brood mares on the range has already been amply demonstrated here. They are as a rule difficult to get in foal and if they produce a colt they frequently fail to raise it, unless the pasture where they are kept is exceptionally good. It would therefore seem that in order to produce horse stock to supply the local and constantly increasing demand, one of two methods must be followed: The one, as successfully adopted on one of the largest ranches in the Territory, consists in first producing the required mares, improved in size, type and conformation, through breeding and selection, and then, by employing high class stallions or jacks, reach the desired result, whether draft horse, mule, saddle horse or roadster, by means of improved animal husbandry methods, care, training and environment. This requires time, money, science and, above all, the climatic conditions and soil without which the proper tissue-producing foodstuffs cannot be obtained. The other method is far simpler and quicker and requires only money for the initial outlay and sufficient pasturage, in order to raise a good-sized, saleable draft or saddle animal. It consists simply in purchasing outright good-sized, improved range mares, already in foal to a registered stallion or jack, and subsequently to breed only those mares, which through their offspring prove themselves of value as brood mares.

The rejected mares, with their colts, should as a rule pay for the additional cost of importation, when disposed of, and their place taken by others.

But the success of this method depends entirely on locating the right kind of animals, and buying them right; and that requires knowledge and experience or else the employment of these qualities in a reliable and responsible agent, which costs money. The above described importation of brood mares shows what the method may result in when some of these qualifications are lacking.

MULES.

The number of mules brought in falls considerably short of that of the preceding years. This is undoubtedly due to the exorbitant prices asked for the same and to their scarcity. On an average the mules arriving here were of better class and age than the usual. As Dr. Elliot of Hilo, in his appended report (see p. 220) has discussed the mule subject fully those interested are referred to his very able article which is based upon actual experience in buying plantation mules during a recent trip to California and Oregon.

CATTLE.

An unusual large number of consignments of pure bred and high class bulls, and heifers, nearly 400 head, especially Herefords and Shorthorns, have been imported by the leading ranches, and at least one of these, the largest one, can now boast that only pure bred bulls are being used for breeding purposes. The general average of the beef cattle of the Territory has, during the past few years, been greatly improved through these importations, and the rigid rules of inspection and testing have excluded any but absolutely sound animals from introduction into the native herds.

There can be little doubt that if the importation of high class beef animals continues the way it has done during the past period, it will not be long before the "scrubs" disappear completely. But besides this it is a pleasure to report that a number of high class bulls of various dairy breeds have been imported recently by leading dairy men as well as by the College of Hawaii, and that there is a strong demand for good bulls even among the Oriental milk producers.

The importation of bulls from New Zealand, which was mentioned in the last report of this Division, did not prove to be what was expected, at least it required nearly a year for the animals to become acclimated and to continue their interrupted development.

Some of them have however developed into fine animals, and that they did not all do so may possibly be due to their not all being very high class. All of the pedigreed animals did well, though not equally fast or to the same extent. The writer is, nevertheless, still of the opinion, that selected animals from New Zealand would prove of great value, on these ranches at least, where fresh blood has been brought in from the States only for a number of years, even though from entirely unrelated strains or families.

SHEEP.

A number of purebred rams, principally Merinos, have been brought in, both from New Zealand and from the States, but while the class of sheep is being improved the importation of mutton from Australia still continues, that is there can be little doubt that the number of sheep in the Territory today is a great deal less than it was two years ago and vastly less than it was six or ten years ago. That diseases, especially external and internal parasites, have a great deal to do with this reduction in numbers cannot be denied, but it is equally apparent that not by far the numbers of ewes are being bred as formerly, whether on account of the diseases afflicting them or because experience has shown that the demand for beef is greater and that it is cheaper to import the mutton from Australia than to use beef-producing acres to raise them. One fact, however, is established and that is that it is an extremely risky undertaking to import rams for the improvement of the flocks, at least to certain ranches. Of an importation of 100 high class Merino rams which were brought here a few months ago from California less than ten remains; and every effort to discover the cause of death has revealed nothing but the presence of the sheep bot-fly in the frontal sinuses. A similar fate encountered an importation of Merino rams from New Zealand to the same ranch two years ago, while the greater part of the same shipment of rams, which arrived here from New Zealand on the same steamer, but which were taken to another ranch on a different island and located at a much higher altitude, did not develop the disease but thrived extremely well, so well indeed that the owner stated that he would not part with one of them for one hundred dollars, even though they cost him less than thirty-five dollars apiece.

It is possible that the higher altitude prevented the development of the parasites with which the animals undoubtedly were infested before their arrival here. but the fact remains that there are vast areas in these Islands that are unfit for anything except sheep-raising, at least so far as our present knowledge extends, but which with their present infestation with external and

internal parasites,—adults, pupae, larvae (maggots) and eggs,—are practically useless for the purpose. The one apparent and obvious remedy, to which attention was called in a special bulletin issued by the writer in conjunction with Mr. D. L. Van Dine of the Federal Experiment Station some three years ago, that is, the introduction of insectivorous birds, has been given little consideration, until revived quite recently.

A chapter in the report of the Assistant Territorial Veterinarian describes in detail the sheep disease here referred to (see p. 205) and it is therefore only necessary to add that in the writer's opinion the sheep industry of the Territory, with the possible exception of the extreme altitudes, is entirely dependent upon the reduction of the disease-producing parasites by the introduction of natural enemies, whether feathered or not.

A considerable importation, 14 rams and 36 ewes, of Tunis sheep, a breed of comparatively recent origin, but supposed to be very hardy and at the same time yielding a fair amount of medium fine wool in connection with a good mutton carcass, arrived for the Molokai Ranch last year, having been selected from the flocks of the principal breeder of these sheep in Indiana, by Prof. Wilcox of the Federal Experiment Station. This was, however, not the first time the Tunis sheep was heard of here, as the same ranch has been using it for years for the improvement of its flocks, and has only been restrained in employing it more extensively by the comparative difficulty in obtaining first class animals of either sex, there being but few established herds in the States and quite a percentage of the offspring showing a tendency to "throw back" to either one of the breeds from which it was developed, that is, emphasizing one characteristic more than what has been decided to be the requisite for the breed. But as all of these characteristics are good, the slightly uneven appearance of the flock is not considered detrimental so long as the essential features of carcass, constitution and clip are maintained.

HOGS.

The past period has seen the Territory provide its own pork, for the first time in a number of years. During 1909 less than one thousand hogs were imported for slaughter, as compared to 6000 or 7000 per annum a few years ago; and during 1910 not a single consignment of butcher hogs arrived in the Territory, but only 21 sows and boars for breeding purposes. Among these were a small flock of mule-foot hogs, half a dozen in all, belonging to a prospective settler, who, however, returned to California, having failed to find the location for a hog and chicken ranch he was looking for. The mule-foot hog resembles

an ordinary half-breed Berkshire pig, except that his hoofs are solid, not cleft. Sometimes only two or three of the hoofs are solid, and sometimes these solid ones show ridges or grooves where the clefts should have been. Fanciers of the breed claim for it almost complete immunity against hog cholera, which, of course, is absolutely unfounded. The owner above referred to had, however, sufficient faith in this immunity to refuse to sell his mule-foots at a reasonable price, somewhat in advance of what they would have been worth as porkers, and had them crated to take back to the Mainland with him.

POULTRY.

The importations of poultry continue to increase. Whether it is due to an increase in the demand or to a falling off in the production cannot be decided, but no notice of any endemic or epidemic among the domestic fowls has reached this office. Large numbers of crates of poultry arrive by nearly every steamer, and any amount of pure-bred chickens of various breeds arrive here constantly. The influx of fancy fowls in one year would fill several poultry exhibits of the size which is usually seen here. Whether the importers eat their fancy fowls or whether the birds go to feed the mongoose is not known, but the fact remains that the birds arrive here in ever increasing numbers.

And still the cold storage eggs and the frozen chicken or turkey command prices commensurate with the reputation of the ice man. Under these conditions it would seem as if poultry-farming would be one of the most lucrative businesses a "small farmer" could engage in, and yet everybody seems to be afraid of tackling the industry in a sensible commercial way. Granted that feed is high here—that is, grain—there still are so many feeds that a chicken can live and thrive on, and which will grow here the year around, that the grain or concentrated food, which might have to be purchased, can be of but little importance, especially in view of the exorbitant prices which poultry and eggs command here.

DAIRY PRODUCTS.

The importation of canned milk, butter and cheese has increased in proportion with the increase in population resulting from the garrisoning of large numbers of soldiers here. There does not seem, at the present time, any prospect of the local dairymen supplying this demand; but the fact that the market is there at all times, eager to buy the fresh product in prefer-

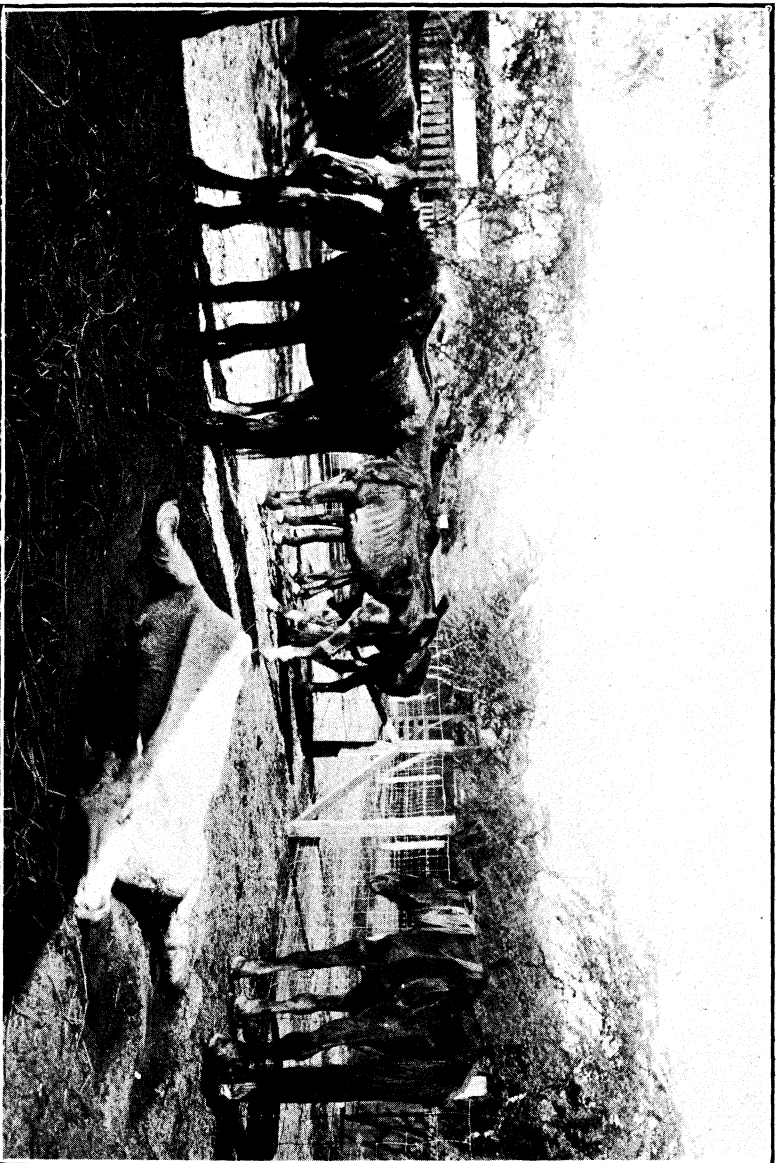


Plate 37. Aged and Crippled Mares Imported for Mule Breeding, but Rejected.



Plate 38. Another Mare from the Same Shipment.
Note festering and crippled condition of front hoof.

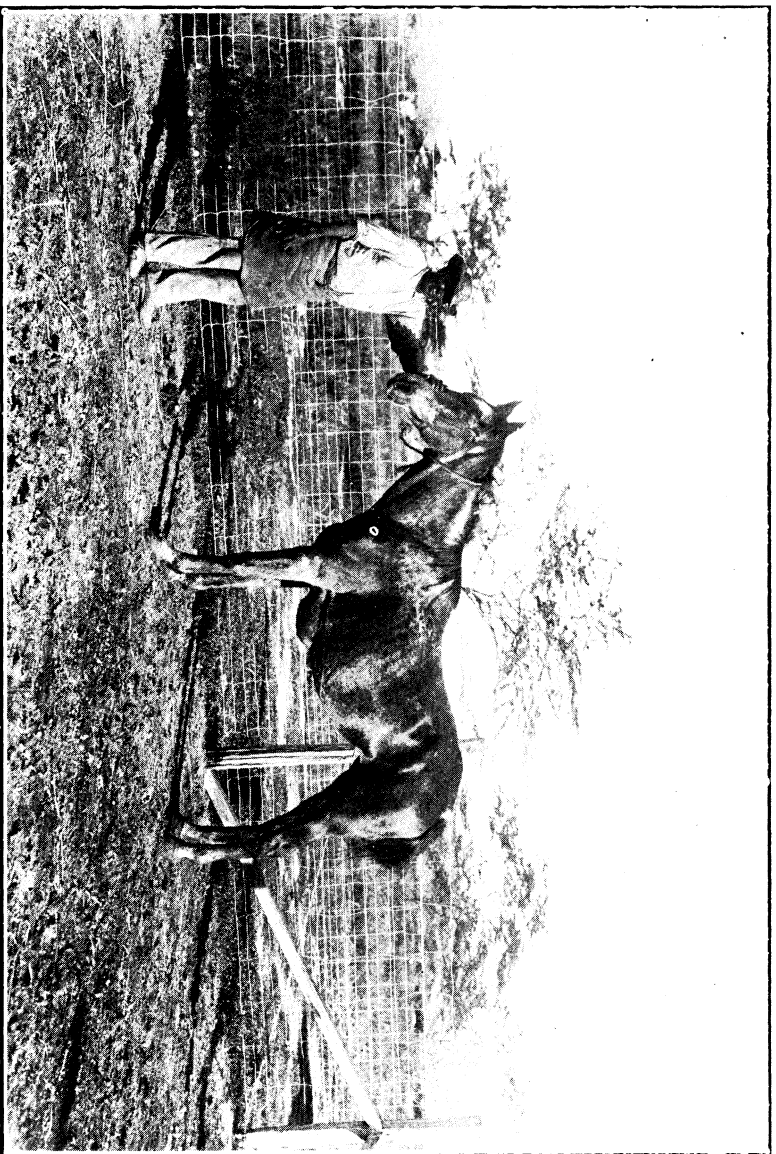


Plate 39, Mare from Same Shipment Developing Purpura Hemorrhagica (Mud Fever).
See Jump under chest.

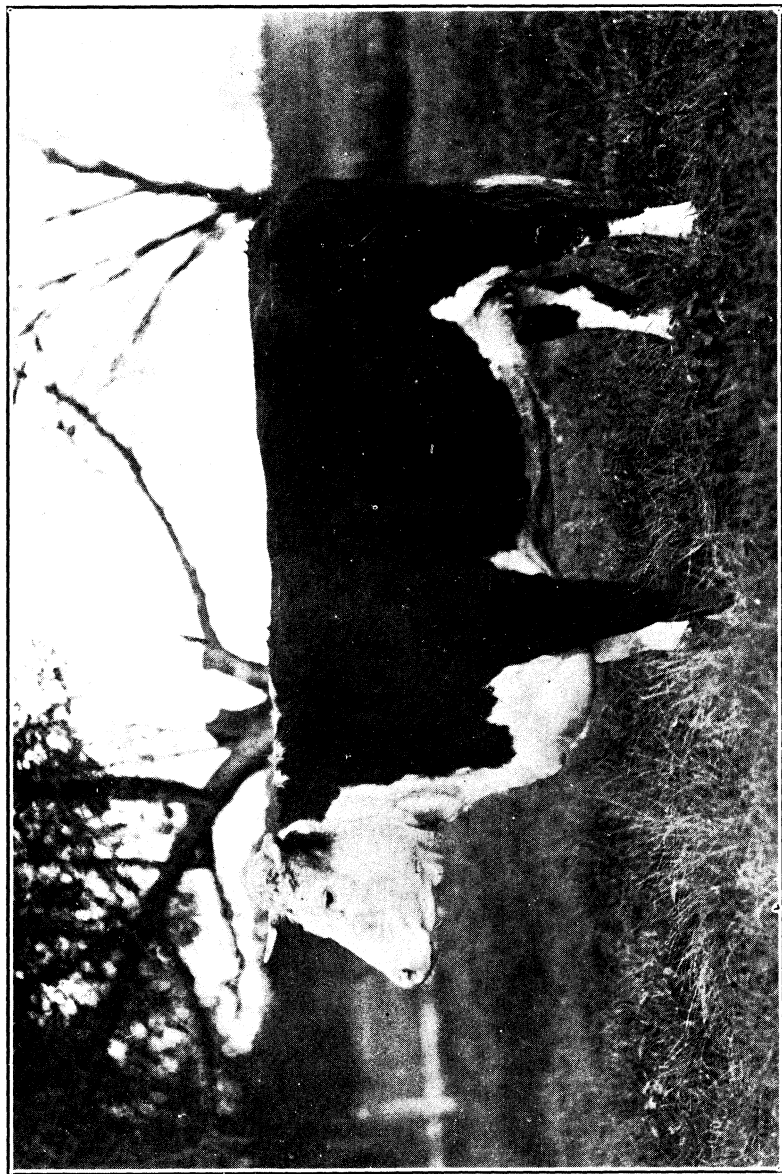


Plate 40. One of a Consignment of Heifers Imported by the Parker Ranch—a perfect animal.

ence to that shipped from either California or the Colonies, should be incentive enough to stimulate the industry into stronger activity.

DISEASES AMONG LIVE STOCK.

It is a pleasure to state that in spite of unfavorable conditions the general health of the live stock of the Territory has been excellent during the past period, as compared to previous years. The Islands remain, as hitherto, apparently immune to the devastating epidemics of the Mainland, all of which, though under complete control, cause losses of millions upon millions of dollars.

A severe drouth during 1909 caused a perceptible reduction in the marketable beef and mutton supply, but conditions soon righted themselves without the appearance of any of those epidemic diseases which frequently put in their appearance whenever the natural power of resistance has been reduced or undermined through prolonged want of feed and water.

GLANDERS.

This most destructive disease among horse stock has been traced relentlessly, not alone in the City and County of Honolulu, but in the entire Territory, and, as will be noted from the appended reports of the deputies, it is becoming less frequent in all districts. In Honolulu a mounted live stock inspector has devoted the principal part of his time for the past period to the periodical inspection of all stables, hack stands, market places and feed yards where experience had shown that cases of glanders were most likely to be encountered; with the result that numerous diseased animals were apprehended and, through them, many others were located. The diagnosis of glanders was in no case left to the inspector, but was invariable verified by the veterinary officials, and in no instance was an animal condemned and destroyed without first being submitted to the mallein test.

Since the last report of this Division was issued, nearly one hundred cases of glanders have been located and disposed of, including those reported by the deputies, and it is safe to predict that only isolated cases of a latent character will be able to evade detection for any length of time. In Honolulu all suspicious cases, as soon as they are reported or come under observation, are taken to the quarantine station and submitted to the mallein test. If found to be afflicted with glanders, they are taken to the dump of the City's garbage division on the Beach Road, convenient to the quarantine station, where they are shot

and a post-mortem examination made for the sake of verifying the diagnosis and making observations in regard to internal parasites.

With the rigid inspection and testing of all horse stock by Federal veterinary inspectors before being admitted to the Territory, there is very little danger of any new centers of infection being brought in, and with deputy veterinarians constantly on the lookout for infected animals here there is every reason to feel confident that the disease will be kept in check until eradicated.

BOVINE TUBERCULOSIS.

This disease has been mentioned and discussed in all the previous reports of this Division, and it is not necessary here to go into detailed descriptions as to its nature, origin, symptoms, course and treatment.

The following is a concise report on the bovine tuberculosis situation in the Territory of Hawaii, with special reference to the City and County of Honolulu, together with such recommendations for the control of bovine tuberculosis, and the incidental improvement of the local milk supply, as the investigations of the Division of Animal Industry during the past eight months, have led me to consider possible, practical and economic. A great number of publications pertaining to the various branches of this subject has been read or consulted, and such means and methods as have been recommended or adopted, with more or less success, by other countries, states or municipalities have been studied with a view to their possible application to our local conditions. As a result of this work it is gratifying to state that our present knowledge of the prevalence of bovine tuberculosis in the Territory, as ascertained by means of the tuberculin test, together with the manifest disposition of a majority of the dairymen and cattle owners to have the disease eradicated from their herds, point to the possible control of bovine tuberculosis at an earlier date and without the excessive losses that were anticipated at the beginning of this investigation.

Unfortunately, the work of the Division of Animal Industry along these lines was forced into premature publication by the untimely appearance in the local press of articles inciting against the use of the meat from animals reacting to the tuberculin test—even when such animals had been butchered under competent veterinary inspection and the meat pronounced fit for human consumption, in accordance with the rules and regulations of the Secretary of Agriculture. As a result the owners of reacting cattle found it practically impossible to free their herds of infected animals without sacrificing them absolutely, or else

found themselves forced to violate the laws of the country by selling milk from diseased herds. Under these circumstances the local authorities naturally found it inadvisable to enforce a new and untested regulation until such time when relief could be afforded through legislation.

My suggestion to the Board that an official quarantine pasture be established for the segregation of all reacting animals, on land belonging to the Territory, could not be carried out for lack of funds. While the land might have been found, fences, water and supervision would require expenditures which could not be met. It therefore became necessary to enlist private enterprise, and a local ranch man volunteered to accept for keep until they could be disposed of such reacting animals as the owners were anxious to be rid of. This relieved the situation to a certain extent, and when it became known that the municipal milk ordinance would not be enforced many others decided to keep their reacting animals in the hope that the coming Legislature might provide relief of some nature.

In the meantime one of the most important parts of the work in connection with the control and eradication of bovine tuberculosis—that is, the location of the centers of infection, was continued and the Division of Animal Industry is now prepared to go ahead with the actual elimination of tuberculous animals from the dairies which supply the City of Honolulu with milk.

INTERNATIONAL COMMISSION ON THE CONTROL OF BOVINE TUBERCULOSIS.

Owing to the great economic and sanitary significance of animal tuberculosis to the live stock industry of America and the many and varied factors which must be considered in formulating measures for its eradication, the American Veterinary Medical Association at its meeting in Chicago in 1909, appointed the International Commission on the Control of Bovine Tuberculosis. The Commission was instructed to study the problem of tuberculosis among cattle and to report upon reasonable and economically practicable methods or systems to be recommended to both officials and live stock owners for eradicating this great scourge of domesticated animals.

At the meeting of the said Association in San Francisco during September, 1910, which, unfortunately, I was unable to attend, the Commission, composed of the most eminent scientific and practical live stock sanitarians of the United States and Canada, made its report, a copy of which has but recently been received. It is gratifying to note that every single measure, method or policy decided upon or recommended by this highest

authority are in every respect identical with those already carried into effect, adopted or recommended here. It would therefore seem reasonable to surmise that the continuation of the present policy and methods, if judiciously supported by the coming Legislature and assisted by harmonious coöperation with the various local territorial and municipal authorities, as well as by the live stock owners themselves, will result in the complete control, and ultimate eradication, of bovine tuberculosis from the Territory, without causing unnecessary hardships or great economic losses.

In order to substantiate my statement in regard to the soundness of the policy and methods recommended and carried into effect here, I take the liberty to quote a few of the resolutions unanimously adopted by the International Commission on the Control of Bovine Tuberculosis, as published in the October number of the American Veterinary Review:

"That tuberculin, properly used, is an accurate and reliable diagnostic agent for the detection of active tuberculosis."

"On account of the period of incubation and the fact that arrested cases may sooner or later become active, all exposed animals should be retested at intervals from six months to one year."

"That any animal having given one distinct reaction to tuberculin should thereafter be regarded as tuberculous."

"That a positive reaction to tuberculin in any properly conducted test, official or otherwise, in any animal in any herd, shall be considered evidence sufficient upon which to declare the herd to be infected."

"If the herd is found to be extensively infected, as shown by the tuberculin test or clinical examination, even the apparently healthy animals in it should be regarded with suspicion until they have been separated from the reacting animals for at least three months. If at the expiration of this time they do not react to the tuberculin test, they may be considered healthy and dealt with accordingly."

"That a policy of compensation be recommended as useful and usually necessary as a temporary measure."

"That when slaughter is necessary, in order to avoid economic loss, every effort should be made to utilize as far as possible the meat of such animals as may be found fit for food on being slaughtered under competent inspection."

"That with the object of preventing the spread of infection, persons buying cattle for breeding purposes or milk production should, except when such purchases are made from disease-free herds which have been tested by a properly qualified person, purchase only subject to the tuberculin test. In order to assist

in the proper carrying out of this suggestion the Commission recommends that official authorities should adopt such regulations as will prevent the entry into their respective territories of cattle for breeding purposes or milk production unless accompanied by satisfactory tuberculin test charts."

"That tuberculin tests made at a distance for public recognition (for example, in other states or foreign countries) can only be done satisfactorily by official veterinarians."

"That all milk and milk by-products used as food should be properly pasteurized unless derived from cows known to be free from tuberculosis."

"The control, to say nothing of the eradication of bovine tuberculosis, is impossible of achievement without the hearty co-operation of the men who are actually engaged in the cattle industry."

"* * * * the establishment of proper coöperation in the great work between physicians, veterinarians, live stock owners, legislators and the public generally, especially appeal to the press, metropolitan, agricultural and local, to join in the work of extending as much as possible among the people the conclusions here arrived at."

"That this Commission recommends the passage of legislation which will prevent the sale, distribution or use of tuberculin by any person other than those acting with full knowledge, or under the direction of official authorities."

"Legislation is especially required to prevent the various frauds which interfere with the satisfactory use of tuberculin as a diagnostic agent for tuberculosis as well as for official supervision of all tuberculin sold to be used by veterinarians and others."

The above quotations constitute only a fraction of the many pages of resolutions and recommendations of the said Commission, but it will readily be seen that they conform in every respect with what has been instituted here up to the present date.

In only one way does the Commission dissent or differ from the policy advocated in the following pages, and that is in regard to the substitution of the intra-dermal tuberculin test as the main diagnostic agent in determining the presence of tuberculosis, instead of the subcutaneous test. This method of testing has apparently escaped the notice of the Commission entirely, as it is not even mentioned in the chapter where the comparative value of the various forms of applying tuberculin is discussed. The Commission merely says:

"As the newer methods of applying tuberculin for test purposes have not been found to be as reliable as the older, subcutaneous method, they cannot be advocated. The opthalmo

and cutaneous tuberculin tests may have a value in some special cases, as for example where doubt exists about the reliability of a subcutaneous test because an animal may have been subjected to some pernicious manipulation. In this sense these later methods of applying tuberculin should be kept in mind."

But while we admit that both of these new methods are impractical and unreliable (the opthalgo test requires the application of the tuberculin to the eye, while the cutaneous test requires the shaving and scarification of a section of the hide), the intra-dermal test, which will be described fully later on, has received no consideration whatever, and is not even mentioned. This is so much more remarkable, as I am of the opinion that this method of testing may revolutionize the entire system or method of bovine tuberculosis control work and facilitate it to an extent which was never dreamt of.

PREVALENCE OF BOVINE TUBERCULOSIS.

The work of ascertaining the extent to which the local herds were affected with tuberculosis was begun during the middle of May, 1910, and embraces up to this date the tuberculin testing of a majority of the dairy animals in every dairy in the City and County of Honolulu, where commercial milk is produced. A total of 2281 tests have been made, of which 545 gave positive result—that is, a percentage of 23.89 of the tested animals were found to be affected with tuberculosis.

Owing to the fact that the official ear-tags had not been received at the time when the work was begun, and to the difficulty of definitely identifying the animals some time after the test and when most of the temporary marks had been worn off, a considerable number of tested animals, both reactors and non-reactors remain unmarked, as follows: 1736 head passed the test, of which number 1371 were ear-tagged, leaving 365 passed animals unmarked. Of the 545 reactors, about 50 head have been destroyed and 426 head have either been branded or permanently marked by cutting half of the right ear off, leaving about 69 reacting or tuberculous animals unmarked. This, however, is of minor importance, as there probably is not a single dairy that has not introduced untested animals since their herds were tested—that is, either fresh cows and heifers, purchased animals or such as for some reason or other could not be tested with the rest of the herd.

As the subcutaneous test, which was employed in the vast majority of cases, requires a perfectly normal condition on the part of the subject, in order to be at all reliable, it goes without saying that a certain percentage of each herd must be left un-

tested or else held for a retest, as no considerable number of animals, especially dairy cows, can all be in absolutely normal condition at the same time.

To definitely determine the prevalence of tuberculosis in any given herd by means of the subcutaneous method will therefore in a majority of cases require repeated visits and the continued application of the test until the last animal has been found in condition for it. This is one of the greatest drawbacks to this test, especially when it is considered that the testing of even one single animal requires the presence of the veterinarian for the better part of two days and one night, during which time the animals must be kept confined or at least under unnatural or unusual conditions, which are liable at any time to unfavorably influence the results of the test. Besides this, a large number of animals can never be brought in a fit condition for it, range cattle for instance, the excitement contingent upon the handling and confinement causing an elevation of the temperature which in a large percentage of cases does not subside while restraint continues, and therefore makes temperature observations worthless.

As tuberculosis is known to affect range cattle, even though to a comparatively small extent, the complete eradication of the disease, with the subcutaneous tuberculin test as the only diagnostic agent at our disposal, would seem practically impossible. And when we consider that the work which has been done so far, and which can only be considered preliminary, has required the attendance of at least two members of our staff, at various dairies, about 700 times, when more than 16,000 temperatures were taken, with nearly 2300 subcutaneous injections, not to mention numbering, tagging and branding, then it can be understood that it was with no little satisfaction that the introduction of a new and easier method of applying this test was met.

THE INTRA-DERMAL TUBERCULIN TEST.

This comparatively new method requires only two visits to each dairy (instead of eight); it does away entirely with the thermometer and the taking of temperatures (the work done so far has required the use of more than a gross of thermometers, at \$1.00 a piece); it can be applied to any animal of whatsoever age, class or condition and under any or all circumstances, whether favorable or unfavorable; it is so manifest in its appearance, and so simple in its application that the veriest simpleton can translate it, and, at the same time, it excels the subcutaneous test in that its effectiveness cannot be circum-

vented for lilegal purposes in obscuring thermal reactions by the administration of febrifuges.

The intra-dermal test was first reported on by two French scientists, Moussu and Mantoux, at the Sixth International Congress on Tuberculosis. It consists simply in the injection of a few drops of a special concentrated kind of tuberculin into one of the two folds of skin (sub-caudal folds) which are found under the tail when it is lifted. The skin at this place is very thin, soft and pliable, and what is most important, denuded of hair. The authors claim that in animals affected with tuberculosis the injection of a small dose (approximately 3 drops) of strong tuberculin would cause a more or less pronounced swelling of somewhat varying character of the injected fold, while the other one, which is conveniently there for comparison, remains unchanged. This test has, during the months of November and December, been applied to nearly 200 animals, many of which had previously been tested with the subcutaneous test, and consequently were known to be either sound or tuberculous. In every instance the results obtained with the new test proved identically the same as the previous ones, and when supported by post mortem examinations the diagnosis was invariably confirmed.

While this method of testing has been given but scant attention by either official or private veterinarians, I believe this to be due in a large extent to the fact that a third method, known as the cutaneous test, was introduced about the same time and has been universally declared impractical by those who have published their experiences with it. The two methods resemble each other in several respects, but principally in the fact that the diagnosis does not depend upon a thermal reaction, but upon the local changes which develop in the reacting animals at the place of application or injection. Another fact which may have tended to obscure the intra-dermal test is, that the article describing it in the proceedings of the International Congress on Tuberculosis appeared in French only, and it was not until Drs. Baker and Ward of California called attention to it at the meeting of the Veterinary Medical Association in San Francisco in September last that it was decided to give it a trial here. Undoubtedly many other veterinarians have by this time experimented with it, and even though the International Commission on Bovine Tuberculosis discourages the use of any but the subcutaneous method for the present, this is, as stated, probably due to the fact that not enough attention has been given to it and that the immense importance of its superiority as a convenient and economic diagnostic agent for tuberculosis in animals has not been realized. The intra-dermal method is equally well adapted

for diagnosing tuberculosis in hogs, the tuberculin in this case being injected in the lower lobe of the ear or just behind and below the ear where the skin is thin. A typical swelling and discoloration of the unpigmented skin takes place, and is generally so well marked that the animal does not need to be confined or restrained for examination.

RECOMMENDATIONS.

With the next Legislature close at hand, no radical measures will be suggested, but the tuberculosis control work, so well begun, should not come to a stop, but should be carried on conservatively, with the main view—to *reduce the number of centers of infection by segregation in special pastures*, and at the same time, so far as possible, to *remove all reacting animals from premises from which milk is sold for human consumption*.

As already stated, there remain in the neighborhood of 400 *known* reactors, of which at least 300 head are segregated in such a way as to practically preclude the possibility of their transmitting the disease to healthy animals, while the milk from them is either fed to calves, pigs or poultry, after being boiled, or else used for cream, after being pasteurized. This leaves, however, one hundred head scattered in smaller dairies where, in many instances, no efforts at either segregation or pasteurization is attempted, the owners simply waiting to see what the authorities are going to do in regard to the enforcement of existing regulations or the promulgation of new ones.

Our present aim should therefore be first to locate and subsequently to eliminate through segregation *all* such centers of infection—whether proven tuberculous individuals or badly infected herds—and, at the same time, to ascertain by means of the new method of testing whether any more of the exposed animals have become infected or whether untested animals have been introduced since the herd was last tested. This will require the testing of all animals over six months old on premises from which milk is sold, produced, distributed, given away, or in any way disposed of. All reacting animals should be immediately removed to premises approved of by the proper authorities, and where contact with healthy or untested animals is absolutely precluded. As soon as a herd is tested the owner should be given not to exceed four days in which to remove the reacting animals and to thoroughly cleanse, disinfect and white-wash his premises, under penalty of having his license to sell milk revoked. It should further be explained to the owners of reacting animals that every effort will be made to induce the coming Legislature to make provision for a just and equitable compensation to the owner whose animals are destroyed or

otherwise disposed of, and that the present removal of such animals from his herd or premises does not mean that he is to lose them, but that it is a necessary measure to prevent the further spread of the disease and the possible transmission of it to human beings,—until such a time when the infected cattle can be disposed of with the least loss to the owner as well as to the community. It will, of course, be necessary for the Board and other local authorities to decide on acceptable pastures or premises for segregation, unless the owner elects to have his reacting animals finally disposed of, but in either case, should the owner feel assured that the Board, through its officers, will render actual assistance in the disposition or removal of tuberculous animals and see to it that the owner realizes the highest possible value from the carcasses of butchered animals.

When the new method of testing has been fully explained, and the dairymen realize how much simpler it is and that no loss of milk and little or no inconvenience to either animals or operators are incurred, the natural reluctance on the owner's part to have his herd tested will be greatly diminished. I am therefore of the opinion that the present force of the Division of Animal Industry, especially if reinforced with an assistant from the Board of Supervisors' Sanitary Committee, will be able to test all of the dairy cattle in the City and County of Honolulu in the course of six weeks to two months. A notice from the same committee to the effect that the present milk ordinance will be enforced from and after a certain date would call attention to the necessity of a retest of all dairy cattle and the removal of all reactors and the cleaning up and disinfection of all infected premises. Before the issuance of a new dairy permit the owner should be made to agree not to introduce reactors or untested cattle to his herd or to allow their presence on his premises under any pretext whatsoever.

SUMMARY OF RECOMMENDATIONS.

1. That the Committee on Animal Industry of the Board of Agriculture and Forestry,—if the above plan for the control of bovine tuberculosis is approved of,—confer with the Sanitary Committee of the Board of Supervisors to ascertain, (a) the views of said committee in regard to the plan under discussion, (b) the inclination of the committee to coöperate with the Board of Agriculture and Forestry in the control of bovine tuberculosis, (c) what measures the committee would suggest or recommend, whether in the form of a new ordinance or the enforcement of the old one, and (d) what actual support the committee might be willing to lend to the carrying out of

the work, either in the form of assignment of employees to assist the veterinarians,—in the furnishing of transportation (automobile hire)—or the printing or publishing of permits, agreements, notices or circular letters.

2. It is recommended that the County Milk Inspector accompany the Territorial Veterinarian or his assistant on all visits to dairies when made in connection with tuberculosis control work, not alone to assist in the work of testing, but in order that he may obtain a complete description of each dairy and the animals it contains, an invoice of all milking machinery and utensils, the existing facilities for the proper handling of the milk and milk products, as well as a description of the general sanitary conditions, such as drainage, sewers, running water, pipe lines, stanchions, floors, milk rooms, etc., so that the record kept in the office of the City and County officials may tally and agree with the one kept by the Territorial officials, and which will deal principally with the sanitation, health, condition, ages, breeds, etc., of the animals and their official ear-tags, marks and brands. Only by coöperation between the two offices can the traffic in diseased animals be prevented and the herds kept clean after the infection has once been gotten rid of.

3. It is further recommended that the new tuberculin test be started with as little delay as possible, and that the appended blank and circular letter be approved of and a copy of each sent to all applicants for milk permits.

4. That the milk ordinance as it now stands will have to be amended sooner or later is obvious. The very fact that it does not regulate or in any way specify what should constitute a dairy or how the milk should be drawn, handled or disposed of in order to make it a safe and sanitary product, is in itself evidence enough that further provisions must be made along these lines, especially when we consider that many of the producers and the laborers employed by them are illiterate aliens (illiterate at least in so far as the language of the United States is concerned), and that no end of rules and regulations would produce the desired result. We will, therefore, sooner or later, have to come to the enforcement of mechanical methods, which cannot be circumvented or misunderstood, and which, on the other hand, will insure that this most important food article—that is, milk, upon the purity and wholesomeness of which the very existence of a vast majority of the infants is dependant, is rendered safe, sanitary and satisfactory. For even though we succeed in eliminating from the dairy herds all tuberculous animals, there still remain the numerous other diseases, such as cholera infantum, scarlet fever, diphtheria and typhoid fever, which may be disseminated in the milk supply.

It must be apparent that it will require time and education to secure compliance with even reasonable safeguards, and it is equally evident that the number of local dairies now in a position to live up to sanitary requirements will supply but a small percentage of the population, although it is hoped that such dairies will be stimulated into existence by trade competition and the refusal of the public to buy dirty milk under any circumstances. Until this is accomplished, however, it is strongly recommended that all milk, unless it comes from healthy cows, as determined by the tuberculin test and veterinary physical examination, and housed, fed and milked under good sanitary conditions, so that the milk at the time of delivery to the consumer does not contain more than 100,000 bacteria per cubic centimeter, be clarified and pasteurized. This, according to the highest authorities (see Bureau of Animal Industry Circ. No. 111, entitled "Sanitary Relations of the Milk Supply"), can be most efficiently and economically secured by the establishment of one or more pasteurizing plants, conveniently located and provided by private enterprise, but under official supervision. All milk not certified to fulfill the above mentioned postulates should be delivered as soon as possible after being drawn at one of these plants or depots and prepared for distribution. Such a step would result in the creation of suitable conditions for the proper handling and storage of milk, sterilization of milk cans and utensils and containers; and the efforts of local milk dealers to provide decent facilities for their fifty or more dairies, scattered all over the city and suburbs, all more or less liable to infection, could be concentrated in one or two plants with a decided saving of expense.

In this connection I would call the attention to what I consider the worst defect of the present milk ordinance—that is, that proper cooling of the milk is not insisted upon. Cooling without ice, in a semi-tropical climate, must of necessity remain a farce. At the public hearing, when the present milk ordinance was discussed before being adopted, both Dr. W. B. Baldwin of the Milk Commission established by the last Legislature, and myself objected to the requirement of only 77° F. as the point at which milk must be cooled and kept "until removed for delivery thereof," as being entirely inadequate to prevent the rapid multiplication of bacteria which is bound to commence from the moment the milk leaves the udder unless infection or contamination is prevented by the most rigid sanitary or hygienic methods as none of these were provided by the ordinance, cooling would seem to have been the one measure that should have been insisted on. However, the argument was advanced that if forced to buy ice many of the smaller dairymen would be driven out of the business or that the ad-

vanced cost of milk resultant upon proper cooling would prevent the poorer classes from providing cow's milk for their children and drive them to use the canned article. This was nearly a year ago, since which time I have given close attention to the subject, and have visited practically every dairy in the city, besides reading innumerable reports, pamphlets, articles and other publications pertaining thereto; and I have come to the conclusion that as it is a question of life and death (in too large a percentage of cases here) and the choice is between filthy uncooled milk (one sample analyzed contained nearly 19,000,000 bacteria per cubic centimeter) and sterilized canned milk, there can be but one way to decide, even though the remedy (cooling) does drive some producer out of the business. The use of ice must result in a slight increase in the cost, but, in the language of Prof. Harrington, "the public needs proper education that clean milk is a necessity, and that infant sickness and funerals can be reduced at least 40 per cent. The filthy producer can even afford to cut prices and take customers away from the other, if customers care to save a cent and make it up in pus and cow dung."

"The most eminent authorities maintain that milk must be cooled to 50° F. and kept there until delivered because the bacteria multiply with astonishing rapidity whenever the temperature of the milk is above 50° F., and if disease germs are present their proliferation augments the chances of infection. A sample of milk which, immediately after drawing, contained 300 bacteria per cubic centimeter increased in 24 hours to 10,000,000, while the same milk kept at 50° F. yielded but 30,000, or but three one-thousandths as many."

There is, in my opinion, very little doubt that the local infant mortality can be materially reduced here, as in every other city or community where the milk supply has been improved and placed on a modern sanitary basis, under official supervision. My personal observations in connection with those made and reported upon by the Legislative Milk Commission have convinced me that a reduction of the milk permits issued by the Board of Supervisors would be of material benefit to the community, if at the same time reasonable but satisfactory standards for what should constitute a dairy were established and maintained. These conditions should include a healthy herd, the use of pure feeds, appropriate stalling and care, pure water, and clean and prompt handling of the milk, which should be of good composition and quality and so free from pathogenic and unnecessary bacteria as reasonable safeguards can provide. If, in spite of such precautions or failure to enforce them, the bacterial content exceeds 100,000

per cubic centimeter, the milk must be sent to an officially recognized milk depot to undergo such treatment in the line of clarification or pasteurization, or both, as shall be decided upon, the milk thereafter to be issued to the producer properly labeled or in officially designated containers, and cooled to not less than 50° F., at which temperature it must be maintained until delivered to the consumer. If no ice cooling takes place on premises where produced, the milk should at least be aerated and cooled by means of running water and sent to the milk depot immediately after milking is finished and without any unnecessary delay. All containers in which milk is carried to the depot should be returned to the owner after disinfection with live steam. A reasonable charge for the treatment, as well as for the use of the containers belonging to the depot, and for disinfection of the containers belonging to the producer, should be agreed upon.

The system here suggested will, of course, require the promulgation of a new milk ordinance by the Board of Supervisors, and the establishment of rules for the production of two classes of milk, one certified to be from clean cows in clean dairies, and the other to be from clean cows and to have passed through a process of clarification or pasteurization or electrifying, whereby the deleterious bacteria and extraneous matter it may have contained has been reduced to a minimum.

CONCLUSION.

After a conference between the Committee on Animal Industry and the Sanitary Committee of the Board of Supervisors of the City and County of Honolulu, it was decided that the tuberculous cows must be removed from the premises where milk for human consumption is produced, but that the cooling process, reducing the milk to a temperature of 50° F., should not be adopted at the present time. The following circular letter was signed by the respective officials and a copy thereof, together with an application blank for tuberculin test, was mailed to each applicant for a permit to sell milk in the City and County of Honolulu. The work of testing the herds is now in progress, and will be continued until all cattle in the County have been tested:

REPORTS BY OFFICERS OF THE DIVISION OF ANIMAL INDUSTRY.

The report of the Assistant Territorial Veterinarian, dealing with various diseases which have been assigned to him for investigation, is hereby presented for the perusal of the live stock owners who have been unfortunate enough to have their animals become afflicted with any of the respective diseases under consideration.

It is a pleasure to announce that after years of effort the Live Stock Sanitary Service of the Territory has finally been completed with the recent appointment of a Deputy Territorial Veterinarian for the Districts of Kohala and Hamakua on the Island of Hawaii. All the principal Islands are thus safeguarded against the spread of infectious and contagious disease which might make its appearance and get beyond control before measures of prevention could be taken through the headquarters in Honolulu. The Islands of Maui and Kauai have now had Deputy Territorial Veterinarians for more than two years, while the Deputy at Hilo, Hawaii, has been located there for more than fifteen years. Their respective reports will prove of great interest to the live stock owners who have learned to know them and to appreciate their services.

Report of the Assistant Territorial Veterinarian.

BY LEONARD N. CASE, D. V. M. (Cornell).

Besides the regular routine work of inspection, testing and the examination of pathological material sent to the laboratory for diagnosis, two trips were taken to the other islands for the purpose of studying outbreaks of disease among the live-stock. One trip to Hawaii in May, 1909, for the purpose of studying "Red Water" in cattle and one trip to Lanai to study a peculiar outbreak in some Merino Rams recently imported.

RED WATER IN CATTLE.

Characterization.

Haematuria or "Red Water" as it is called by many is a contagious disease of cattle in these islands characterized by advancing anemia, emaciation and the passage of blood in the urine.

Distribution in the Territory.

The Island of Hawaii has furnished the majority of the cases, the principal infected districts being Kona and Hamakua. A few cases have been reported from the Island of Maui. As far as known no cases have appeared on the other islands.

Elevation seems to have some effect upon its prevalence as the majority of cases are reported from an elevation of between 3000 and 4000 feet. Just why this should be is not apparent.

History.

This disease has been known to exist in these islands for a long time and is considered by many to have been brought here from New Zealand and Australia in early importations.

Very little had been done in the way of investigation until May of 1909 when an attempt to inquire into its cause was made at the Horner Ranch, Hamakua, Hawaii.

The ranch in question furnished 18 cases of the disease, 16 of which were comparatively recent being of about three weeks duration, the remaining two cases had been showing symptoms for a period of eight months and were what might be termed chronic cases.

Symptoms.

The symptoms of this disease are not many and mostly of a secondary nature and are such as usually attend severe and continued hemorrhage. The most prominent symptom and the one which gives to the disease the name "Red Water" is the voiding of bloody urine.

At first the urine is but faintly tinged, but as the disease progresses the color becomes deeper and deeper until it is almost the color of pure blood. Urination is more frequent in the affected animals.

It is most difficult, in the early stages of the disease, to pick out the affected animals from external appearances. They have not lost much flesh and while in the corral look no different than the others. Upon the drive, however, those affected lag behind show signs of weakness and exhaustion and in every instance the urine of these stragglers is blood stained.

Closer examination reveals the anemic condition of the animal; all visible mucous membranes pale to whiteness; rapid, weak pulse and accelerated breathing upon the least exertion.

Blood Examination.

For the sake of convenience in prosecuting the investigation the seven animals selected for study as presenting the most typical symptoms were placed in a corral close at hand where they could be examined daily. For the sake of reference the animals were numbered from one to seven, inclusive.

In all cases where an examination was made the blood was examined in the fresh and stained preparation. In staining smears three stains were used, viz: Jenners, Wrights and Eosin and Methylene Blue. The percentage of Haemoglobin was determined by Tallquists Haemoglobin Scale and the cellular counts were made with the Thoma Haemocytometer using the chamber having the Zappert-Ewing ruling.

For reasons given later no blood examination was made on Cows No. 1 and No. 7.

Table of Blood Examinations with Differential Leucocyte Count.

No.	Red cells	White cells	Haem	Lymph.	Mono	Poly.m	Eosins	Mast cells
Cow No. 1	No count was made							
" " 2	4,200,000	15,960	76%	58.7 %	0.1%	29.7%	9.9 %	1.4 %
" " 3	3,500,000	16,000	50%	57.2 %	0.0%	36.4%	8.85%	0.285%
" " 4	2 000,000	16,800	40%	76.6 %	0.3%	14.8%	7.5 %	0.6 %
" " 5	4,840,000	12,500	40%	54.09%	0.2%	44.8%	0.5 %	0.1 %
" " 6	2,500,000	8,500	40%	58.8 %	0.2%	31.0%	9.2 %	0.8 %
" " 7	No count was made							

The cellular count of the blood of normal cattle as given by a number of observers ranges from 4,200,000 to 5,473,000 of red cells and between 5,486 and 8,241 of white cells per cmm. Dimock and Thompson obtained the following percentages of the different varieties of leucocytes in the blood of normal cattle.

Lymphocytes	Mononuclears	Polymorphs	Eosins	Mast Cells
54.2%	1.4%	30.5%	13.15%	0.59%

The above percentages are given as average results.

A study of the above table will show that a continual loss of blood had produced an oligocythemia and a marked leucocytosis in all but No. 6, which shows a slight, if any, rise in the number of white cells. The differential leucocyte count does not materially differ from that found in many normal cattle.

A study of the stained preparation in all the above cases disclosed all those changes dependent upon long continued haemorrhage such as poikilocytosis, punctate basophilia, polychromasia, increase in size of some of the cells and nucleated red cells. The blood of Cow No. 4 presented a typical picture, all the different changes in the red cells being present.

Blood Parasite.

In studying the blood a coccus-like body was observed in some few of the red cells. As seen in the fresh preparation it had a faint pink color and was motile but not actively so, taking two hours to cross the cell. Careful focusing upon it brought out a darker central body probably a nucleus. They varied in shape according to their movements, but when at rest were always circular. Some few were observed free in the plasma, but the entire number of parasites, intra-cellular and extra-cellular, were not numerous in any preparation.

In the fixed preparation the parasite took a bright blue stain with all the stains used. Some of the parasites showed very well the darker central spot. In size, as measured by the Micro-

meter Ocular and 1/12 oil immersion, they varied from 0.5 to 3.5 microns. In form they were always circular and rarely were they found occupying a central position in the cell, being usually situated near the margin. A few were found outside the cell.

Morbid Anatomy.

Post-mortem examination failed to reveal any generalized condition of disease. In five animals killed a very careful examination proved that all the internal organs were in an apparently normal condition in every case with the one exception of the bladder. Of all the organs in the body this is, apparently, the only one affected. When the abdominal cavity is opened and the bladder exposed the most striking feature in every instance is the marked engorgement of the superficial capillaries and small veins. Almost the entire surface is covered with the swollen net-work.

Upon opening the bladder the exposed mucous surface presents a variety of conditions. In some it is covered with raised patches, varying in size and irregular in outline, and varying in color from straw-color to blood-red, thus differing from the remaining portion of the mucous membrane which is of normal color and thickness. Other bladders will show, besides these irregular patches, ulcers and numerous papillomata varying in size from 1 mm. to 3 and 4 cm. and blood red in color. Occasionally a bladder will be found the mucous surface of which will be thickened and granular throughout and deep red in color. In almost all bladders will be found a blood clot varying in size from one inch in diameter to the size of the closed hand.

Etiology.

Apparently the only tissues affected are the mucosa and sub-mucosa. In the normal bladder the sub-mucosa consists of a thin layer of loose connective tissue containing a rich capillary network. The mucous surface is composed of stratified epithelium of a type known as transitional.

Under the influence of the etiological element of "Red Water" there is a great proliferation of connective tissue and dilatation of the capillaries, pushing up the mucosa and forming the irregular raised patches and papillomata found upon macroscopical examination.

In all cases after a certain length of time rupture of the capillaries occurs causing an infiltration of the sub-mucosa with blood much of which finds its way through the loosened and desquamating epithelium into the bladder staining its contents more or less deeply and thereby giving rise to the most characteristic symptom of the disease.

In the meshes of the connective tissue, especially directly underneath the mucous membrane, there may be found large numbers

of cells for the most part circular in outline and containing a centrally located nucleus which is rich in chromatin taking a deep haematoxylin stain. Some of the cells show a vacuole near the nucleus while in others there is a clear space completely surrounding the nucleus.

The shape of the nucleus varied from circular to oval and the majority of the cells contain but a single one. In some cells, however, there may be found several chromatin bodies all more or less circular in outline, differing in size some being large some small and scattered anywhere in the protoplasm of the cell.

Those cells directly underneath the mucous membrane and those found in the epithelium itself show very extensive nuclear changes the nucleus being divided into many parts of different shapes held together by delicate chromatin threads. In those cells containing the single undivided nucleus the protoplasm takes a faint haematoxylin stain, but in many of those cells in which the nucleus seems to be in the process of division the cell protoplasm takes a faint eosin stain. This condition may picture a second stage in which the original nucleus is undergoing division and has broken up into several parts.

Another stage of this parasite seems to be that in which the cell protoplasm disappears and the nuclear forms are set free. These nuclear forms then become encysted in the epithelial cells of the bladder, which cells having now become infected with what might be called the sporozoite and undergoing desquamation are passed in the urine and so form the means of passing the infection. From a study of the morphology, process of division and multiplication of this parasite it would seem that it should be classed as a coccidium.

In the study of this disease attention was first directed to the parasite found in the red blood cells as the etiological element. This opinion, however, was soon abandoned, first, because from the morphology of this parasite its similarity in different animals and the fact that only one form could be found, it was apparent that it was in a resting and therefore quiescent stage.

Cover glass preparations from liver and spleen failed to show any different forms the few which were found exhibiting the same form as those found in the circulation; second, post-mortem examinations verified the above conclusion by showing that the disease was of a local and not a general character as evidenced by the bladder being the one and only organ in the body affected. As far as known in all cases of disease of piroplasmic origin post-mortem examination reveals its generalized character, the liver and spleen being greatly altered in size and consistency, and while examination of the blood may reveal parasites in rounded forms only, smears made from the liver and spleen show a variety of forms and in larger numbers; third, this disease shows a haema-

turia, that is, the presence in the urine of the red blood cells, in contra-distinction to the haemoglobinuria of diseases of piroplasmic origin.

In the consideration of the above conditions attention was forced to some parasite working in the bladder itself and the study of the peculiar cells found in such large numbers in the sub-mucosa lead to the conclusion that they are the etiological factor in this disease.

Prevention.

In this disease treatment seems to be of little avail, prevention offering the best mode of entirely ridding a locality of this infection. Separate the healthy from the sick animals and transfer them to a clean paddock, slaughter at once those animals affected with the disease, burying or burning those which are too emaciated to have any food value. The paddock in which the affected animals were found should not be used for stock for at least a year.

EYE WORM IN CHICKENS.

Characterization.

A parasitism prevalent among chickens in these islands causing more or less loss and characterized by the presence of the *Filaria Mansoni* in one or both eyes.

Distribution.

Filaria were first noticed in the eyes of chickens in China (Cobbold) and it was, no doubt, introduced from that country and Japan with fowls brought here by the Chinese and Japanese. It is found in all parts of these islands though more abundant in some localities than in others.

Etiology.

The worm which causes the trouble and which is known as the *Filaria Mansoni* belongs to the Nematode or Round Worm group. They are capillary worms, silvery white in color, and varying from 10 mm. to 13 mm. in length.

At present little or nothing is known of their life history, and how they get into the eye and are transmitted from one affected bird to another is still a mystery. Inoculation experiments with both ova, young worms and mature worms have failed to produce any results.

Symptoms.

The most noticeable symptom is a more or less severe conjunctivitis in one or both eyes. The part the worm plays is a purely mechanical one, interfering with the normal working of the eye and setting up the usual irritation caused by the prolonged presence of any foreign body.

When the irritation and resulting conjunctivitis is severe the eye is greatly inflamed and badly swollen, the discharge serous at first soon becomes muco-purulent in character and forms yellowish crusts around the margin of the lids; the bird is constantly rubbing the head against the sides of the wings which become smeared with discharge. Every morning finds the affected eye closed tight, the lids being held closely adherent by the discharge, but in a short time by constant rubbing the eye may be opened a little.

When conjunctivitis is present in one eye only there is little or no apparent effect upon the general health of the bird; it remains lively and keeps in good flesh. In the mild type the eye soon clears after the worms disappear, but in the severe type the inflammation increases with the result that sight is impaired and the eye lost. When found in both eyes the result is total blindness. The bird stands with head drawn in toward the body and the feathers ruffled; driven on by hunger it moves uncertainly here and there in search of food and makes ineffectual efforts to pick up things from the ground. The natural result of such a condition is starvation and the only remedy is the axe.

The number of worms seems to have little to do with the conjunctival symptoms as at times birds will be found harboring from ten to fifty worms in each eye without apparently suffering any inconvenience, at other times three or four worms will set up intense irritation.

Treatment.

In severe cases which have been allowed to run some time medicinal treatment is of little avail. The man who wishes to make a success of poultry raising must necessarily keep close watch of his birds. No case is severe in the beginning although some develop more rapidly than others. When taken at the start the treatment is very simple consisting merely of flooding the eye with some bland solution, such as borax in water, and removing the worms as they appear from under the lids. Many will be washed out entirely, but some will have to be removed with a pair of fine forceps, which is not always easy when there are many.

After all worms have been removed the following prescription will be found very useful in allaying the inflammation:

Rx

Sodii biborat.	grs. X
Aquae Camphorae	
Aquae Destil.	aa Z VIII
Adrenelin Chloridii	Zss

M

Sig: 3 drops in each eye 3 times daily.

When birds are found harboring these worms they should be removed from the healthy and treated immediately and not returned to the flock until all symptoms have disappeared.

SHEEP BOTFLIES IN CALIFORNIA RAMS ON THE ISLAND OF LANAI.

One hundred Merino Rams imported from California August 18th were taken to the Island of Lanai, after a short rest at the Quarantine Station at Honolulu, where after a period of a little over a month and a half they commenced to die at the rate of three or four a day. An investigation into the cause of the outbreak was delayed on account of an accident to the Territorial veterinarian and when his assistant arrived there remained only twenty-two alive out of the original number of one hundred. Of these two were beginning to show symptoms of sickness thereby furnishing a chance to observe the symptoms from the beginning.

Symptoms.

The affected animals showed little desire for food and soon stopped eating altogether. They did not move with the rest of the flock, but stood by themselves with back arched, abdomen drawn up and head hanging low. There was bilateral discharge from the nose, muco-purulent in character and greenish-yellow in color.

Considerable irritation seemed to be present in the head as evidenced by the nervous condition, repeated sneezing and shaking of the head, continued champing of the jaws and grinding of the teeth. No deflection of the eyes was observed, but at times they held a strange staring expression and were more or less blood-shot while the pupils were slightly dilated.

The extreme nervousness of the afflicted animals was shown by sudden starts, snorting and attempts to bury the nose in the bushes or litter on the ground. When nibbling a little at the grass they would suddenly start, take a few steps backward, draw the nose in toward the chest and sneeze once or twice as if trying to expel some irritating substance, all the time grinding the teeth.

On the day following only one remained alive, the other one having died during the night. Weakness had now become so great that the animal could not assume an upright position, but lay upon its side, breathing regularly and the heart beating one hundred and twenty per minute. The eyes were partly closed, but bright, the pupils were normal, and the conjunctiva slightly congested. Every little while the animal would go through run-

ning movements with all four legs, keeping it up for about a minute at a time, during which the head rested upon the side of the nose, the horns being slightly raised. The eyes were now wide open, turned a trifle downward and the pupils so greatly dilated that only a thin rim of the iris could be seen. When the paroxysm passed the animal would draw a long breath as of relief, the eyes would close and the breathing become regular; this resting stage would last four or five minutes, sometimes longer, and be followed by another paroxysm until finally death occurred.

Pathology.

Autopsies were performed upon five animals with the following results:

The internal organs of both body cavities were found in an apparently normal state in all cases examined. In three cases a very careful examination was made of the head. The nasal mucous membrane was found highly congested but not greatly thickened; the nasal chambers contained a considerable amount of greenish-yellow muco-purulent material; the maxillary sinuses congested and the mucous membrane greatly thickened; the frontal sinuses exhibited a highly inflamed condition the mucous membrane so greatly thickened as to almost fill the cavity, the small, lumen left being filled with a greenish-yellow excretion. A large number of bots (larval forms of the *Oestrus Ovis* or Sheep bot-fly) of different ages, most of which were nearing maturity were taken from the frontal sinuses. The brain showed slight congestion over the anterior portion of the cerebral hemispheres.

During life smears were made from the nasal discharge and from blood taken from the ear. The former showed the usual variety of bacteria, while the blood showed nothing abnormal. After death smears were made from the heart blood, lungs, liver, spleen, kidneys and intestines, microscopical examination of which gave negative results. The stains used were Jenners and Methylene Blue.

Some time was spent in careful observation of the other sheep on the ranch and a large part of the twenty-five thousand animals were seen at one time or another. Not a sick sheep was observed among them. During this time certain symptoms were observed which would seem to indicate the presence of the sheep bot-fly on the island.

While quietly feeding and nothing around to alarm them it was noticed that suddenly one would start, snort or sneeze, run a few paces with the nose close to the ground or try to hide the nose in the low bushy patches of grass. Sometimes they would raise the head, turn it quickly from side to side as if dodging

something, rub the nose against the legs, sneeze a few times and then quietly resume feeding. At other times two or three would run together trying to hide their heads in each other's flanks. These actions all point to the presence of the bot-fly.

Prevention and Treatment.

The various lines of treatment available are not at all practicable when dealing with large flocks. Medicinal treatment consists of smearing the margin of the nostrils with some material offensive to the fly and pine tar has been highly recommended for this purpose; but this is only practicable with small flocks. For the range it has been recommended that a log bored full of holes with a one-inch augur be placed at different points where the sheep are apt to gather as around water troughs or springs; the holes are filled with salt and a liberal supply of tar placed around the edge of each. Sheep as a rule are very fond of salt and in obtaining it from these holes smear their noses more or less with the tar. The injection into the nostrils of benzine, turpentine and such like materials causes as much irritation and loss as the presence of the grub itself. Extreme care is necessary for successful results.

The trephining of the frontal sinuses and extracting the grubs with forceps or washing them out with a disinfectant cannot be applied economically to a large number of animals because of the time and expense involved.

In the way of prevention the sheep should be kept from fly-infested land. If this is not possible they should be inspected at frequent intervals and those animals which appear to be heavily infested with grubs should be killed and the head burned and the number of flies kept down in this way.

Conclusions.

1st. That the death of the imported rams was due to the intense irritation of the larvae of the sheep bot-fly with which they were heavily infested.

nd. That the activity of the larvae at this stage was due, perhaps almost entirely, to the change in climatic conditions surrounding the rams.

3d. That the affected rams were infested with the larvae before leaving California.

4th. That the actions of the native sheep would indicate the presence of the sheep bot-fly on the Island of Lanai, but that these animals were better able to resist their effect than the imported ones.

5th. A careful search of the pastures for poisonous weeds failed to give positive results.

Report of the Deputy Territorial Veterinarian for the Hilo District for 1909.

By

H. B. ELLIOT, M. R. C. V. S.

General Observations.

The weather conditions in the Hilo District were, on the whole, more favorable than in the previous year, but other districts suffered severely from lack of rain. Serious losses were also incurred on several ranches from the prolongation of the endemic of Catarrhal Fever, which made its appearance in 1908. This reached its height in the first quarter of the year, and then gradually subsided, only occasional cases being recorded during the warmer months. The mortality among plantation animals was unusually small, and a gratifying feature of this report will be noticed in the fact that both the plantation stables and the ranches were entirely free from Glanders. The attention of livestock owners is directed to the apparently increasing prevalence of parasitic diseases among native-bred horses and mules, which may at some future time prove a matter of serious concern.

Port Inspection.

During the year 1909 there arrived at the port of Hilo the following livestock, poultry, dogs, cats, and hares:

Mules	153
Horses	13
Cattle	29
Hogs	116
Poultry (crates)	89
Dogs	1
Cats	2
Belgian Hares	4

CONTAGIOUS AND INFECTIOUS DISEASES.

Glanders.

During 1909 one case of this disease was detected in the stable of a Chinese stage-driver whose premises are situated in the town of Hilo. Owing to a previous infection in this stable a

close supervision had been maintained, and upon the appearance of clinical symptoms in a second animal, it was immediately destroyed.

In the absence of notification from the larger stables and ranches we may assume that they have been free from glanders during this period. It may not be amiss, however, to remind owners of livestock that failure to notify the authorities of the presence of contagious diseases upon their premises renders them liable to severe penalties, and that, particularly in this disease, early notification of suspicious cases is to their own benefit.

Undoubtedly the prevalence of glanders in former years has been largely due to continued reinfection from the Mainland. A striking instance of this danger, and of the necessity for vigilant inspection at the port of shipment is afforded by the case of a horse purchased in San Francisco for export to Hilo which, after being twice submitted to the mallein test and rejected each time, finally developed clinical glanders. Latent cases of this nature are the most dangerous to the community, and the ability to prevent them from being brought into this country is a most important asset in a campaign of eradication.

Another source of continued infection on Hawaii has been the presence of what may be termed "nests" of glanders in out-of-the-way parts of the Island, where, from ignorance of the seriousness of the disease, it was allowed to spread without any attempt at restriction. Bitter experience has, however, given stock owners a liberal education in this respect, and as they become more enlightened the danger from this source diminishes from year to year. With the northern districts of this Island under closer veterinary supervision, it may be predicted with some degree of certainty that the eventual eradication of this disease will be only a matter of a few years.

Quarantine Station at the Port of Hilo.

Since January 1, 1908, at a conservative estimate of \$250 per head, about \$160,000 worth of horse stock (including mules and asses) have been landed at the port of Hilo. The largest number of animals in quarantine at one time was one hundred and two, and the greatest number of consignments on one vessel was six. The present regulations governing the importation of horse stock make it very necessary that the quarantine facilities at this port shall be considerably extended, and I strongly recommend that proper premises be provided that will accommodate at least one hundred animals, will allow each consignment to be separately isolated, and will furnish the quarantined animals with the

shelter and protection that are found in ordinarily equipped private stables.

The value of a careful veterinary inspection before shipment is illustrated by the fact that no cases of contagious diseases have been detected at this port since the present regulations went into force.

The mule stock was consigned to various plantations on this Island, and the quality of the animals was fairly good, although hardly up to the average of the previous year. The number of actually defective animals was small, and the majority conformed to the standard of size and weight. No diminution was noticed in the proportion of aged animals—mules already past the prime of life—and it is in this respect that the principal loss of actual value and deficiency in working capacity is incurred by the purchasers.

Endemic Catarrhal Fever.

This disease received detailed consideration in my report for the previous year. The endemic reached its height in the first quarter of 1909, and was the cause of very serious losses in some parts of the Island. The greatest proportion of fatalities occurred among ranch animals running on pastures at an altitude of several thousand feet above sea level, and was due to exposure to cold winds and driving rain, and to the difficulty of placing the animals under suitable conditions for proper treatment. Where animals could be taken under treatment in time, and where shelter was available, the mortality percentage was much lower. Upon the advent of warmer weather the severity of the outbreak gradually diminished, and since then only occasional cases have been noticed.

Actinomycosis, or Lumpy Jaw.

This disease, which has been dealt with at some length in a previous report of this Board, is reported at various times from different ranches on this Island, although it is very rarely seen on the coast lands. It is necessary to call attention to it again, because it is stated that in some parts considerable laxity and carelessness is shown in handling the affected animals. While the fact must be taken into consideration that inoculation experiments with infective material have usually resulted in failure, and that actinomycosis, or lumpy jaw, is not classified among the strictly contagious diseases, ranch managers who wish to keep their stock free from this disease will do well to observe the following precautions:

(1) To treat only the animals whose value is sufficient to repay the expense and trouble involved.

(2) To isolate all animals under treatment in paddocks reserved for this purpose, and to which no other stock have access.

(3) Affected animals of small value should be destroyed so soon as noticed, and the diseased parts either buried or cremated.

Miscellaneous Infective Diseases.

Osteoporosis. A few sporadic cases of a mildly chronic nature were seen among animals working on stage lines; but the severe type of this disease that was common among plantation stock several years ago is very rarely encountered now, and no serious endemic has occurred for some years.

Epizootic Cerebro-Spinal Meningitis. This very fatal disease has not visited the districts adjacent to Hilo for several years, but a few sporadic cases were noted in the Kau District.

Tetanus. During 1909 one case of this disease was seen in a stable in the town of Hilo. The history of the case was typical, infection gaining entrance through a punctured wound in the foot. The interesting feature lies in the exceeding rarity of this disease on this Island, this being only the second case noted in fifteen years' practice. This infrequency of occurrence is corroborated by the experience of local medical practitioners, and is remarkable, because the warm, humid climate of the Hilo districts would appear to form an ideal environment for the propagation and distribution of the specific bacillus of this disease.*

Parasitic Diseases of Horses and Mules.

Species of parasites. The parasites here considered are principally those confined to the digestive tract, and belong to families widely distributed over the surface of the globe. Advanced cases of Parasitic Anaemia in this country usually present a mixed infection, in which the *Ascaris megalocephala*, the *strongylus armatus*, and the *strongylus tetracantus* are constant factors; in addition, larvae of the *oestridae*, *spiropterae*, *oxyurides*, and one or more families of tapeworm may be found. Carcasses are occasionally seen in which all of these parasites are present, and the total number that a single individual may harbor, and still remain alive, is almost incredible. The case of mixed helminthiasis reported by Krause, and cited by Neumann as the most remarkable on record, would hardly be considered noteworthy on this Island, where *post mortem* examinations fre-

*One of the leading surgeons of Honolulu has recently corroborated this observation by expressing his surprise that in a climate where half of the native population go barefoot the year around no more cases of tetanus or lockjaw are observed. V. A. N.

quently reveal conditions in which the figures quoted are not either equalled or else surpassed.

Occurrence. It is exceptional to find a carcass that is entirely free from parasitic infestation, and it may be safely assumed that at least 90 per cent. of the animals on this Island are affected to a greater or lesser degree. In the majority of cases the number of worms present is not sufficient to cause any perceptible lowering of the standard of health, and the host does not suffer any appreciable inconvenience. On the other hand, a change to a less favorable environment is frequently followed by marked development of the symptoms of parasitic disease. On ranches the mortality during prolonged periods of drought is largely due to this cause, and it is the principal factor in the losses reported among foals, and yearling colts and fillies.

A considerable number of the young animals purchased for use at sea level show symptoms of parasitic diseases during the first twelve months, and the percentage of death is very high. Undoubtedly accessory causes contribute largely to this result—change of climate, of food, the excitement of unaccustomed work, and the processes of growth and dentition. Horses from certain parts of the Island appear to be more subject to parasitism than those from other districts, and among these the proportion of badly affected cases is greater in the “scrub” stock than in the class of animals which show more breeding. Young pack mules appear to be peculiarly susceptible to this trouble, and many fail under the conditions of plantation work.

The number of deaths that are seen annually leads to the conclusion that parasitic diseases are the worst scourge among horses and mules that the Hawaiian stock owner has to contend with, and there are good reasons for believing that this condition is becoming more widely spread and more prevalent with the passage of time. It is a matter of common knowledge that pastures that are in continual use sooner or later become tainted with parasitic ova, and it is very probable that the same process is taking place in this country.

Symptoms. Very various symptoms may be produced by the presence of parasites in the digestive tract, and it is known that in the past many obscure diseases have been erroneously attributed to this cause. For our purposes, however, we may roughly divide the morbid phenomena exhibited on these Islands into two classes: the chronic, wasting anaemia which results from interference with digestion, or actual abstraction of chyle and blood; and those arising from invasion of the blood vessels by the agamous form of the *Strongylus Armatus*.

The symptoms of Parasitic Anaemia are ill defined, and have no precise significance. The animal gradually loses weight, and

the bony skeleton becomes increasingly prominent under a hide-bound, staring coat of hair. The mucous membranes are pale and bloodless, sometimes faintly tinged with yellow. The appetite may be capricious, rarely shows serious impairment, and is often voracious until the end. Movements are languid, and exertion quickly provokes fatigue. At times the faeces are diarrhoetic and loose, but more often they are of normal consistency. Lifting of the tail frequently reveals the margin around the anus stained with white mucus. In very advanced cases of Parasitic Anaemia paralysis is a frequent complication. Occasionally this paralytic condition is more apparent than real, and results from extreme weakness; but more often it partakes of the nature of a true paralysis, and is probably caused either by toxic effects upon the nervous system or circulatory obstruction. The only diagnostic symptom is the detection of the worms or ova in the faecal discharges, and it is noteworthy that some of the worst cases under observation very rarely voided adult parasites, although the number disclosed by *post mortem* examination was almost inconceivable.

The symptoms and effects of invasion of the blood vessels by the *Strongylus Armatus* have already been discussed in previous reports of this Board. This worm, by its pernicious activity in the intestines and circulatory apparatus, is responsible for most of the losses that are incurred in both of the types of disease mentioned, and, unfortunately, it is the one that offers the most serious resistance to therapeutic measures. In fatal cases of Parasitic Anaemia thousands of these worms will be found clinging to the mucous membrane of the bowels, and in exceptional cases they may be encountered in other situations outside of the intestinal canal. Their presence has been noted in fatal attacks of Haemorrhagic Colitis; they may be safely credited with many attacks of Colic of obscure origin; and they are almost invariably the direct cause of the sudden deaths from haemorrhage into the abdominal cavity that are seen in plantation stables.

Prophylaxis and Therapeutics. It has been proved that many of the species of parasites which infest the digestive tracts of the lower animals gain entrance in the form of ova or embryos during the processes of ingestion of food or water, and it has been assumed that this method of transmission is common to all of those found in the intestines of the horse. The almost accidental discovery of the method of entrance through the unbroken skin of the human parasite, the *Ankylostomum Duodenalis* or "hook worm," suggests the possibility that the strongyles of the horse, whose life history has not been fully revealed, may be discovered to be an exception to this general rule.

Neumann very properly remarks "that the prophylaxis of in-

testinal helminthiasis is necessarily vague, as we do not know the conditions upon which the development of the intestinal entozoa depend. The purity of food and of drink, the use of dry pastures and the exhibition of a tonic nourishment are almost the only general measures that can be recommended." Ranches upon which large herds of horses graze over a wide tract of country are, therefore, not afforded much scope for self-protection, and the only apparent procedure which might promise successful eradication, namely, burning over large areas of grass land in periods of dry weather, is one that is rarely practicable. On the plantation it may be safely surmised that the principal source of infection is the pasture usually adjacent to the stable in which the stock are turned loose when not working; and this is especially true when this pasture is a fifteen or twenty-acre field, used year after year for this purpose, not always well drained, and always covered with just sufficient verdure to tempt the animals to crop the grass. A small paddock, scraped bare of vegetation, is ample provision for the needs of the well-fed, hardly-worked plantation mule, and contains fewer elements of danger.

The objects of therapeutic treatment must be two-fold, namely, to sustain and increase the vitality of the patient, and to expel the offending parasites.

To secure the first an abundant supply of nutritious food and pure water, comfortable surroundings, and carefully regulated exercise are essentials. Molasses or rock salt will be found useful adjuncts to the daily rations. Where the external environment is prejudicial from some cause or other, removal to more favorable surroundings will often effect a complete and lasting cure. Young native-bred horses, even when in advanced stages of this disease, if returned to those higher altitudes that they have been accustomed to in earlier life, and properly cared for as regards food and work, usually regain condition without the adventitious aid of drugs. This is the practice adopted by a transportation company in Hilo, who are probably the largest purchasers of native-bred stock on the Islands, and it has been found very successful.

When resort to medicinal treatment is unavoidable, the prospects of a favorable termination depend very greatly upon the stage of the disease. If the subject is still in unimpaired health, the risk attending large doses of drastic remedies is lessened, and the chances of recovery are excellent; the intermediate stage, at which time treatment is usually commenced, offers a very uncertain prognosis; and the final stage, when emaciation and weakness are pronounced, is almost invariably hopeless. Theoretically, the proper course to adopt would be to submit these young animals indiscriminately to treatment when they are first brought into the stable, but practically this is attended with much

difficulty. Forcible administration of medicines to half-broken, refractory animals is always a dangerous operation; if attempted, certainly the medicament should be given in capsules rather than in the shape of drenches. Powdered drugs, given with the food, do not possess much efficacy, although ascarides may be expelled by this method. A useful prescription for this purpose is the following:

Tartrate of antimony	2 drams
Santonin	1. dram
Calomel	40 grains

given in the feed once a day for four or five days in succession. Tartrate of antimony, which appears to be highly valued in Germany as a vermifuge, has also the great advantage of being administrable in the animal's drinking water, and from 2 to 4 drams may be given in this vehicle three or four times in the same day at intervals of three hours.

The principal obstacles to successful treatment are undoubtedly the large comparative area of the equine intestine, and the dilution and absorption the vermifuge undergoes before coming into contact with the caecum and colon. To overcome these there are certain conditions that must be observed: the patient must be fasted for twelve or eighteen hours before treatment; and vermifuge is to be conjoined with, or preferably followed by, a dose of purgative medicine.

Good results have been obtained with thymol, oil of turpentine, extract of male shield fern, tartrate of antimony, santonin, kamala, creolin, and other drugs. Those mentioned have all been used extensively in this practice at different times, and the most profitable prescription has been found to be a mixture of 3 ounces of oil of turpentine, 2 drams of male shield fern, and from 8 to 10 ounces of linseed oil; given daily for three or four days, and repeated as often as found necessary. Judging from the very effective treatment of human "hook worm" disease, thymol would appear to be the appropriate drug for the expulsion of strongyles, and is commonly used for this purpose in Great Britain. In attempting to find the best methods of administration, two Hawaiian-bred horses, about 750 pounds in weight, and unmistakably affected with Parasitic Anaemia, were placed under treatment as follows:

(1) Fasted for eighteen hours previously, no food being given during treatment. Thymol, 15 grains dissolved in 1 ounce of alcohol, given in milk three times at intervals of three hours. Purgative next day, castor oil.

Results—nil.

(2) Same enforced abstinence from food. Thymol, 2 drams, added to solution containing 4 ounces of magnesium sulphate.

Given three times at intervals of three hours. The mixture is chemically incompatible, and difficult to administer unless the thymol is added immediately before administration.

Results—free purgation; both animals voided large numbers of ascarides; only a few strongyles.

(3) Fasted as before. Thymol, 2 drams given in capsules, three doses at intervals of three hours. Purgative, 12 ounces of Glauber's salts.

Results—free purgation; a few ascarides; no strongyles seen; toxic effects noticed in one animal after third dose.

Shortly after the last experiment one horse died, and its stable companion, being in a hopeless state, was slaughtered. The autopsies on each revealed very extensive parasitic infection, the intestines from the duodenum to the rectum containing a writhing, wriggling mass of thousands of active, healthy worms. The action of the thymol upon the strongyles was evidently very slight, and inclines one to receive with dubiety published reports of cures effected with doses of 15 and 20 grains.

Report of the Deputy Territorial Veterinarian for the Hilo District for 1910.

By

H. B. ELLIOT, M. R. C. V. S.

General Observations.

This period was an unusually favorable one for livestock on the plantations throughout the Hilo districts, the mortality percentages being low and the amount of serious disease very small. The improvement in the situation with regard to glanders noted in my previous report was continued, and I am pleased to be able to record that no cases of this disease were seen. The catarrhal fever affecting the respiratory tract of equines appeared in some stables, but the cases were of a benign nature, and there was very little spread of infection among in-contact animals. Osteoporosis, on the other hand, was slightly more prevalent than for some years past; several reports of spontaneous fracture being undoubtedly due to this cause, and other cases of more typical form were noticed in the smaller stables belonging to stage-drivers and storekeepers. A few cases of tuberculosis in cattle were diagnosed by the use of the tuberculin test, and there is

probably a promising field for its application among the local dairies in the vicinity of the town of Hilo. The writer visited the Pacific Coast during the last two months of the year, and, at the request of the Territorial Veterinarian, has appended to this report a brief summary of his observations regarding the condition governing the livestock market there.

Port Inspection.

During the year 1910 there arrived at the port of Hilo the following livestock, poultry, etc.:

Mules	183
Horses	26
Cattle	4
Dogs	1
Poultry (crates)	57

Quarantine Facilities at the Port of Hilo.

In my report for the year 1909, reference is made to the necessity of providing more extended accommodations at this port for the quarantining of imported animals in accordance with the regulations of the Board of Agriculture and Forestry. Our experiences since then have amply justified those observations, and compel me to again draw attention to our lack of facilities for the proper administration of these regulations. The present system entails much additional expense to the importer, and, in the event of the occurrence of those heavy and continuous rainstorms which are liable to sweep over this locality at any time, valuable animals are subjected to actual danger of sickness and loss of life. One consignment* of one hundred and two mules were exposed, from lack of proper shelter, to drenching rains during the whole of their quarantine period, and, although fortunately the amount of actual sickness was not great, the loss of condition among these animals was most marked. The question of feeding so many animals in an open pasture also presents many disadvantages; a number of the animals were kicked and bruised, at least one-fourth of the hay given was trampled in the mud, and some of the mules were unable to obtain sufficient food in spite of the ample quantities that were delivered. I personally accompanied this consignment from San Francisco to Hilo, and must admit that the element of risk to these animals was greater in quarantine at this port than at any other stage of their journey, either on the train or during a rough passage over the ocean. This is a matter that can only be remedied by

*Quarantined January 8-21, 1911.

the erection at this port of a well-equipped, modern quarantine station on the same lines as the one at the port of Honolulu, with possibly some modifications to meet the severer climatic conditions due to the excessive rains.

Milk and Meat Supply of the Town of Hilo.

Meat. Animals for the supply of the local market are killed in a private slaughter-house without either ante- or post-mortem examination for the purposes of determining the presence of disease communicable to human beings. The sanitary condition of this slaughter-house is controlled by the regulations of the Board of Health, and comes within the province of the local inspectors of that Board. On the whole it may fairly be said that in spite of the absence of strict supervision of these food products the market in Hilo is exceptionally well served both in the quality of the meat sold and its freedom from disease. This is due to the fact that the trade is in the hands of reputable individuals, and that their supplies are principally drawn from the local ranches, where the percentage of such communicable disease is very small. It is not believed that there is any immediate need for the introduction of governmental restriction and inspection in the marketing of these products.

Milk. This trade suffers from a combination of unfortunate circumstances, and presents a much more difficult problem for consideration. The dairies are owned mostly by Portuguese and Japanese, and, as at present managed, appear to be barely remunerative, although milk retails at a price that would seem to afford a fair profit. The cattle used are of inferior quality, and are pastured upon lands too infertile for the growth of cane and not of much value for any other purpose. The buildings, if not actually insanitary, are very unsuitable for the use they are put to, and in some instances are in a dilapidated state of unrepair. The methods of obtaining, handling, and marketing the milk are, to speak mildly, exceedingly primitive. The introduction of a system of periodical testing and careful physical examination at frequent intervals of the dairy cattle would ameliorate some of the worst conditions, but is not, of itself, sufficient to guarantee the provision of a pure, uncontaminated supply of milk; and the issuance of a complete set of modern milk ordinances would probably put 50 per cent. of these small dealers out of business on account of lack of capital to comply with the requirements. The roots of the problem lie in the lack of capital, poor pasturage, and the absence of an intelligent application of those principles which experience teaches are absolutely necessary for the profitable marketing of dairy products. The simplest and most effective method of dealing with this question would be the estab-

lishment by local capital of a model dairy, and provided that a suitable location could be obtained, and that the enterprise was placed under competent management there is reason to believe that this would offer an opportunity for lucrative investment. In the absence of this, I may briefly suggest the most practicable method of dealing with the situation:

The issuance of an ordinance: (a) introducing an improved system of licenses renewed at frequent intervals with issuance dependent upon a proper observance of the regulations of the ordinance; (b) compulsory labelling with the name of the owner of vehicles, cans, packages, etc.; (c) specifying certain necessary details in the construction of milking sheds—*i. e.*, the nature of the flooring, provisions for a supply of running water, etc.; (d) enforcing and specifying methods of cleanliness in stables and in the processes of milking, and handling and marketing the milk; (e) prompt notification of illness among producers and handlers of milk; (f) enforcing periodical application of the tuberculin test and physical examination of all dairy cattle.

At the start these regulations should be as simple and elementary as possible, and the detail of additional expense occurring to the dairyman in complying with the ordinance must be kept carefully in mind. In the course of time the growth of public sentiment will compel strengthening of the weak places in the ordinance, and new regulations can be put into force which will then meet with little opposition. The increase of population in this town demands that at any rate a beginning shall be made towards the improvement of these conditions either by the Territorial or local authorities.

The Mule Market on the Pacific Coast.

During the latter part of the year the writer traveled extensively through Northern California, Oregon, and Washington, and was afforded an excellent opportunity of studying the conditions prevailing in the livestock market there, particularly with regard to the available supply of mules. Statistics show that the number of mules in the two Northwestern States is comparatively small, and my experience compels the opinion that there is very little promise at present of this section of the mainland affording an available supply for the Hawaiian plantations.

In California there does not appear to be any mule market in the strict sense of the word, and sound, workable animals appear very occasionally in the auction rings. The demand for such animals is keen and the price is apparently regulated by the inclination, or necessity, of the farmer to sell; there is evi-

dently no fixed scale of values. Speaking generally, however, it may be said that the prices asked for animals suitable for agricultural work on these Islands ranges from \$200 to \$350, according to age and weight, and where the latter, which is a "fancy" figure, is asked, the animal is exceptionally fine, and the seller is indifferent whether a sale is effected or not. It was my opinion that the Hawaiian planters could purchase their livestock to better advantage by establishing a buying agency at San Francisco, in charge of an expert; this appears, in the present state of the market, to be doubtful, because the scarcity of mules for sale makes the scope for selection very limited, unless the buyer is prepared to pay the higher prices that are asked. Excepting small bunches collected by local dealers, thrown on the market by the termination of construction contracts, or by the ranches, the salable animals are scattered throughout the State in twos or threes on the valley farms, and if the number of mules required is large recourse must be had to the medium of dealers who know the country and where the animals can be obtained. It is my opinion that, where fair value is given for the money, the average price paid by the planter now would seem to represent not more than a reasonable profit to the dealer when his incidental expenses—locating the animals, feeding, testing, and shipping—are taken into account.

There does not appear to be any ground for supposing that the present high prices will decline in the near future; indeed, the indications may be said to point the other way. Until the later nineties the supply of mules at all times outstripped the demand; then came the heavy drain for purposes of warfare and big exportations to Hawaii and the British colonies, followed by an unprecedented influx of population, the placing of wide areas of new land under cultivation, the development of immense construction projects all over the Pacific Coast, and an increased demand from the cities. This demand for power is bound to keep on increasing, and can only be met by breeding more animals or the substitution when possible of mechanical for animal power. The prevailing high prices for mules may cause breeders to pay more attention to this branch of their industry, but, and this applies equally to local conditions on these Islands, so long as the rancher or farmer can get equally good prices for horses there is very little inducement for him to embark in the hazardous and expensive business of raising mules. The commercial motor will eventually displace many horses on the city streets, but as yet it can hardly be said to have evolved from the experimental stage. The prosperity which has accrued to the farmer in more recent years provides him with means to experiment with costly mechanical devices, and a gasoline traction engine,

the "caterpillar," which displaces at least twenty-four head of mules, is gradually being introduced onto the level fields in the Californian valleys. So far the basis of experience with this machine is too slight to form an opinion as to whether the farmer can operate it successfully or not; certainly it will require considerable mechanical ability on the part of the owner or his employes to keep it in constant use. Finally, we may say that the price of mules must always bear a certain relation to that of horses, and that this will have at all times a steadying effect upon the market.

At present mules from the Eastern markets are being brought in increasing numbers to the Pacific Coast, and these sources of supply might be a profitable subject of investigation from the point of view of the local importers.

The obvious solution of the problem of obtaining mules for the Hawaiian plantations, namely, the development of the local supply, is the one that should be adopted, and every encouragement should be given to stimulate this industry. There is every reason to believe, judging from the statistics relating to importation in previous years, that the local market can be entirely supplied by the ranches on these Islands. Animals equal in every respect to those imported have been raised on Hawaii, and what has been done in a few instances can be repeated almost indefinitely if the proper conditions are observed. But the ranch company or owner intending to go into this business should only do so after giving the matter careful consideration. It is useless to endeavor to grow heavy mules on lands only fitted for sheep grazing; an ample supply of good feed during all seasons is an absolute necessity. Good jacks and large sized mares are also necessary factors, and probably it will be found that the business can only be conducted successfully on those ranches where the home-bred mares have already been graded and improved in size. When recourse must be had to importations of mares for this purpose, preference should be given to young, unbroken range mares of a type that can adapt themselves to local conditions, and are sufficiently heavy to produce good-sized stock. The idea of introducing broken-down city mares for mule breeding is ludicrous and a waste of money. The development of this industry will require time and the investment of considerable capital, but with an advantage of at least \$50 per head in favor of the local breeder it will prove profitable, and each year will see an increasing number of suitable native-bred mules placed upon the local market.

Report of the Deputy Territorial Veterinarian for the District of Maui.

By

J. C. FITZGERALD, M. R. C. V. S.

I herewith beg to submit my report as Deputy Territorial Veterinarian for the Island of Maui, for the years 1909 and 1910. Probably the most noticeable features of this period have been the improvements made in animal husbandry methods, such as the feeding and care of work animals in general, and a steady decline in the number of outbreaks of glanders. The building of veterinary hospitals and the remodelling of stables, cow-sheds and barns have added much to the welfare and conservation of the animals of the district. The efforts of the Board of Agriculture and Forestry in providing supervision and advice has been appreciated by the livestock owners themselves, and every assistance has been given the writer in accomplishing the work that has been done.

ANIMAL DISEASES ON MAUI.

Glanders.

It is gratifying to notice that the number of outbreaks of glanders and also the number of animals slaughtered is steadily decreasing. This is, of course, accounted for principally by the number of animals that have been slaughtered, ceasing as conveyors of this disease. Twenty-three outbreaks have occurred during two years. As a result of these, 47 animals have been slaughtered, and some 480 which were in contact with them were subjected to the Mallein test. The figures below are given showing the decrease in outbreaks and numbers of animals slaughtered during 1910:

1909—	15 outbreaks	34 destroyed
1910—	8 “	13 “

The outbreaks encountered have chiefly been situated in Central Maui, and their origin has been in most instances traced to some ill-fed, ill-kept animal, usually the property of an Oriental. It has now become an established rule in all the plantation stables that no animal, other than those owned by the company, is permitted the use of the stable or watering troughs, and that no animal is purchased or allowed to be stabled on the premises

without first undergoing a veterinary examination. The chief source of danger remaining as a distributor of glanders is the public road side "tie-up" post, and it is the writer's opinion that more cases are contracted from them in this country than by any other means, as the public watering trough, which is a doubtful kindness, is practically unknown in the island. This statement is chiefly based on the fact that in the majority of inoculated cases with skin lesions and in most cases of epizootic lymphangitis the eyes are the principal seat of infection, and the lesions are first noticed in that vicinity. It is therefore strongly advised that these "tie-up" posts be disinfected at least every week with a solution of bichloride of mercury, 1 in 500.

Cerebro Spinal Meningitis.

Cerebro spinal meningitis is by far the most fatal disease amongst horse stock in the Islands today, and it is a regrettable fact to note that it is undoubtedly on the increase. Within the past two years some 25 cases have been brought before the writer's notice, 15 of these having proved fatal, and in the majority of cases so rapidly so that no treatment could be administered. This number is against 10 deaths from other causes. These figures show that the death rate amongst horse stock from this disease alone is higher than from all other causes (glanders excepted). The seasons of 1909 and 1910 have been exceptionally rainy, which may to some extent account for the increase of this disease over previous years, as there is no doubt in the writer's mind that the chief cause is a fungoid toxemia produced by eating moldy foodstuffs..

In July, 1910, just after a very heavy wet spell, I was called one morning about eight o'clock to a private stable containing nine saddle and driving horses, the owner stating that one of these had, after eating its breakfast, fallen down and was unable to arise. Upon arriving I found the animal suffering from cerebro spinal meningitis in its most acute form, and in a comatose condition. Death took place about half an hour after my arrival. Whilst a post mortem examination was being made, the stable boy came to tell us that two more of the horses were down. I returned to the stable and found them both in about the same condition as that in which I had first seen the animal already dead, although they had been examined and appeared quite normal but an hour previous. Shortly after this another was attacked, and before evening all four were dead. Four of the remaining five animals were also affected, but their cases being much milder they recovered under treatment. A search was made for a feasible cause for this condition. This was continued for some time unsuccessfully, until, being informed by

the stable boy that new barley and oats had been received three days previous, I examined the bottom of the grain bins and the remainder of the old grain which, owing to the heavy rain having beaten through the walls of the feed room, had become wet and was covered with green mold. In this connection it should be observed that the only horse of the nine in the stables who did not contract this disease was a new arrival and had been fed only with the new grain. The bins were cleaned out and the grain was given to an Oriental with the understanding that it should be cooked and fed to his pigs only. However, one week later I was called to this man's premises and found two horses suffering from cerebro spinal meningitis. After much beating about the bush I finally elicited from him the statement that he had fed some of the old grain to the affected animals. This case has simply been mentioned in support of the fungoid toxemia theory, and also as a warning to stock owners during the rainy season.

Tetanus.

Although this disease is rather rare in the Hawaiian Islands outside of Honolulu and its vicinity, four cases have nevertheless appeared on Maui in the past two years. Experimental treatments were adopted in each individual case with a view to testing the large dose theory of antitetanic serum which was suggested by one of the leading German physicians. The results of these experiments proved very satisfactory, as three of the four animals recovered. The method adopted in each case was upon diagnosis to inject subcutaneously four doses of Messrs. Parke, Davis and Company's antitetanic serum at one time. This was repeated every six hours until the tetanic symptoms abated. The dose was then gradually reduced for about eight days and the interval gradually increased. The curative properties of antitetanic serum have been at all times questioned, but probably this is accounted for to a great degree by the fact that the dose has nearly always been insufficient. If any conclusions should be drawn from the above mentioned four cases, it will be that antitetanic serum certainly does possess curative properties when given in sufficiently large quantities, and that no harm can be done by administering a dose greater than that required to neutralize the toxins already formed.

Liver Fluke Disease.

This disease is so common in the low-lying lands of this Island that it is safe to say that almost 80% of the cattle grazing anywhere in the cane belt or on the irrigated lands or in the

pastures where the irrigation ditches run is affected to a greater or lesser degree. On the other hand, the disease is extremely rare in the mauka lands, and it is unusual to see an affected liver in cattle from those districts. The writer has had the opportunity to confirm these observations from the periodic examination of carcasses slaughtered for food purposes. As it is impossible to fence in the irrigation ditches in the pastures and so combat this condition without cutting up the pastures in such a manner as to make them entirely unfit for the requirements of a cattle ranch, troughs have been placed in all the pastures in convenient positions so that the cattle may have free access to salt and bone meal. It is believed that this step will prove very effective in diminishing the prevalence of this disease.

Tuberculosis.

Several of the principal ranch dairies were subjected to the tuberculin test during the year 1909 by request of the owners. These tests were made with very satisfactory results, as for example one dairy of 80 head of milch cows gave only five reactors. These animals were slaughtered and post-mortem examinations made which proved that in each instance that the animal was suffering from tuberculosis. This in conjunction with the number of carcasses that have been examined at the slaughter-houses, a few of which have shown lesions of tuberculosis, would tend to indicate that this disease is not very prevalent on Maui. Only four carcasses were condemned in 1909 as unfit for food on account of tuberculosis. During the latter part of 1910 a supply of official tuberculin ear tags and a branding iron to be used on the reacting cattle were received from the Honolulu office, and the work of making a systematic test of all dairy herds was begun. The test of two dairies was completed, one showing five reactors out of 13 cows, while the other gave only three out of 20. Owing to the extremely heavy rains this work had to be stopped until conditions should be more favorable for a satisfactory and thorough completion of the work.

VETERINARY HOSPITALS.

Two veterinary hospitals have been installed on Maui, one at Spreckelsville by Mr. F. F. Baldwin, manager of the Hawaiian Commercial and Sugar Company, and the other at Paia by Mr. H. A. Baldwin, manager of the Maui Agricultural Company. These hospitals have been built and equipped in such a manner that nearly any medical or surgical treatment can be administered on the plantation in a way that could not have been contemplated before their erection. In their construction every-

thing has been done to economize time and labor and at the same time to allow for treatment impossible under the old conditions. For the benefit of the readers a description of one of these hospitals might be of interest. The Hawaiian Commercial and Sugar Company's hospital at Spreckelsville is a building 90 feet long by 30 feet wide, with a span of roof 25 feet high at the apex. The foundation is of concrete sunk 18 inches into the ground. The hospital is situated some 500 feet from the main stable, quite close to the sea, and in one of the healthiest localities on the plantation. It stands in its own grounds of about two acres, and is surrounded by a ring fence 5 feet 6 inches in height. The building is divided, as the appended ground plan shows, into an office, store-room, operating-room and eight loose boxes. The floors are all of concrete, and the building is practically vermin and mosquito proof.

Loose Boxes. These are 12x12, and are equipped with beams and carriages, so that any animal may be placed in slings whenever necessary. The mangers as well as the feed and water boxes are portable, so that they can be taken out for disinfection and cleansing and also in case any projecting fixture might be a source of danger to a patient. The floors are composed of oiled macadam sloping to a drain, and have as bedding about 18 inches of fresh beach sand, which is changed whenever necessary, and after each patient has been discharged. The doors are regular half-doors, the upper half being substituted by a wire gauze screen when left open. Pillar rings are placed in each stall in convenient positions for securing animals' heads after blistering and restraining "bandage biters."

Operating Room. This is a room 30 feet by 30 feet, built with double tongue-and-groove and with a grooved concrete floor. It is equipped with foot and shower bath and washing sink. Light is supplied by eight windows placed on two sides and by two large skylights immediately over the operating table. The necessary plumbing for all forms of irrigation and cold water treatments is supplied. Animals undergoing the cold water treatment in cases of lameness are restrained in narrow standings 4 feet wide which are supplied with pillar reins and slot bars, the water being furnished from pipes projecting from the wall some 5 feet above the middle of the animal's back and to which flexible rubber pipes are attached. A stock is placed in one corner for minor operations and for dressing fractious animals. A casting bed is provided in the hospital yard for young and wild animals which could not well be restrained for operation without danger of injury in the operating room.

Dispensary and Storeroom. These are both of painted tongue-and-groove, double walled. The dispensary is 20x12, and

the storeroom 10x12. They both have smooth finished concrete floors. The dispensary is fitted with sink, dispensing tables, shelves, dust-proof instrument cases and desk, and has also a complete equipment of drugs and surgical instruments.

It might be added that the building is so constructed and the drainage is such that absolute cleanliness may be attained with very little effort, and the entire place is thoroughly disinfected daily. The hospital yard is divided into the yard proper and a small pasture of about half an acre in which convalescents can take sun baths and exercise. A sand bath is in the course of construction, and will be a valuable addition.

HYGIENE AND MEAT INSPECTION.

A systematic inspection of stables, dairies, piggeries, and slaughter-houses has been instituted and carried out during the past two years, with a view to the betterment of the general health and hygienic conditions; the various plantations have paid considerable attention to this subject, and many improvements have been made, notably the erection of new stables, remodeling of dairies and building of veterinary hospitals, which will be described later.

Stables. All stables are white-washed and disinfected every six months, and, wherever necessary, more frequently. Wherever possible cement flooring has been put down in feed rooms and feed passages, and all possible precautions have been taken to exclude rats and mice. Attempts have been made from time to time to lessen the number of flies which congregate in the stables and which are not only a menace to the comfort of the animals, but frequently a source of great danger in transmitting the infection when contagious diseases are in the vicinity. This has been accomplished to a great extent by using fresh beach sand in place of the cane trash used as bedding heretofore, and which when fermentation of the sugar juice took place was a great attraction to flies. This sand bedding is changed every month, or more frequently if necessary. All stable manure and refuse is removed from the stables daily and dumped at a considerable distance.

Dairies. General inspections have been made of dairy cattle, dairies and milk utensils. Concrete floors have in nearly all instances been substituted for the old-time wooden ones in the milking sheds and milk rooms. Under the old conditions it was almost impossible to keep these in a sanitary state. Every effort is made to keep all dairies and their surroundings in perfect sanitary condition.

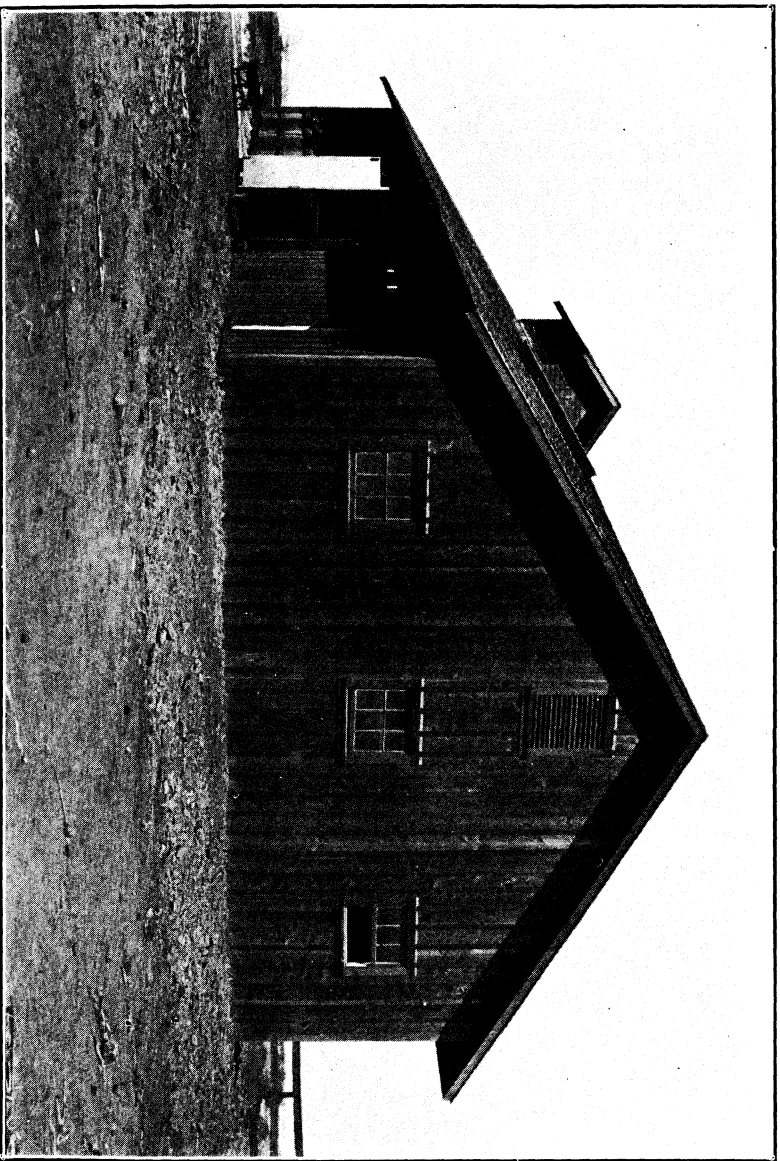
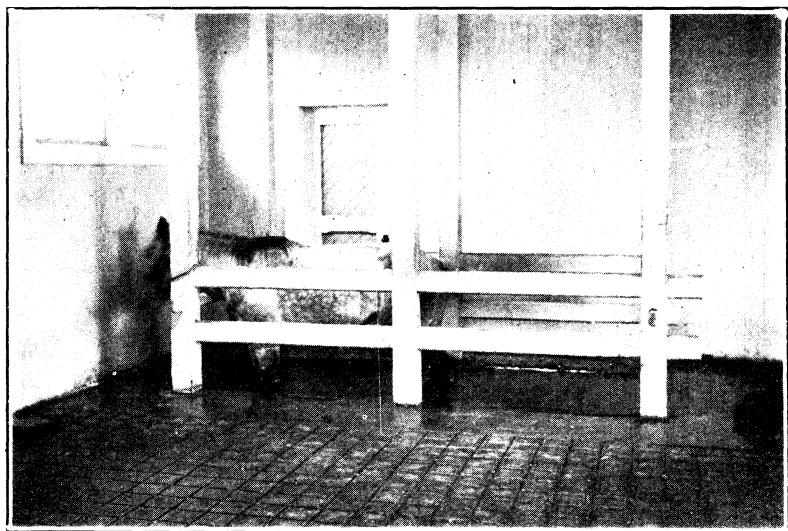


Plate 41. Veterinary Hospital, Maui.



Horse Bath in Operating Room.

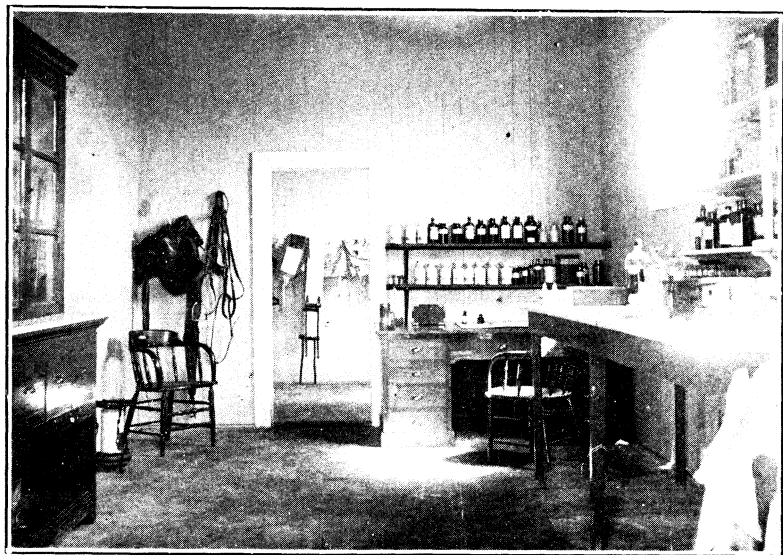
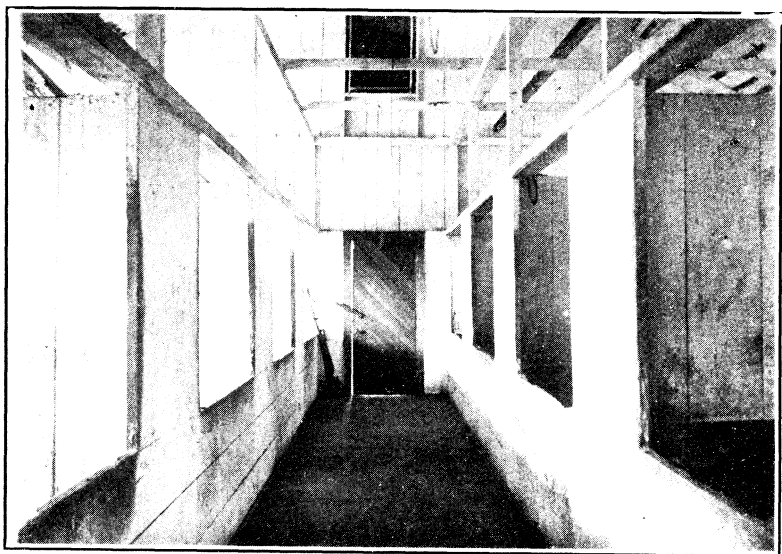


Plate 42. Dispensary, Camp I Hospital.



Interior of Loose Boxes, Camp I Hospital.

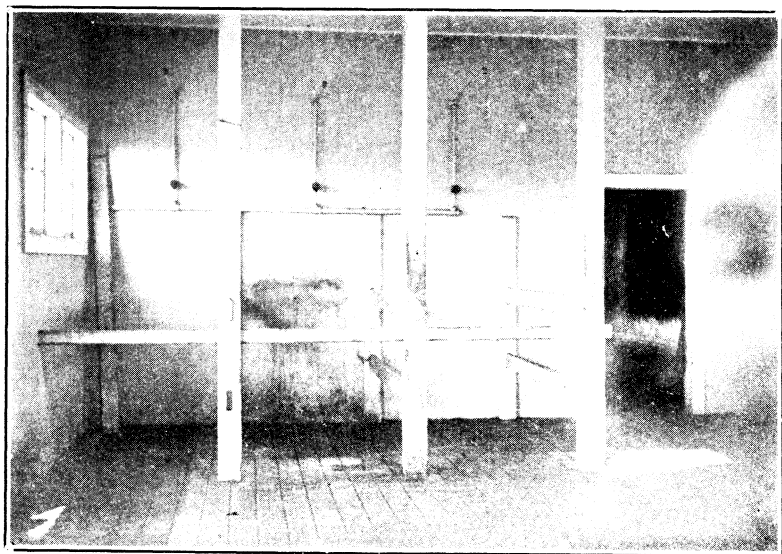


Plate 43. Cold Water Treatment Apparatus, Camp I Hospital.



Exterior of New Stables, Camp I.

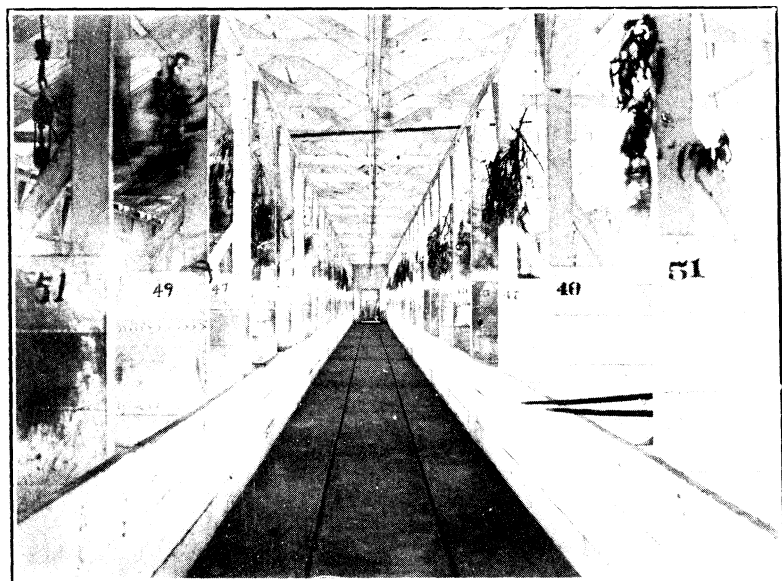


Plate 44. Interior of Half of New Stables, Camp I.

Slaughter-houses. The writer has endeavored as far as possible to institute a system of meat inspection which would insure the marketing of clean and healthy meat, but owing to the scattered location of the slaughter-houses and the limited amount of time at his disposal it is far from what could be desired. Thanks, however, to the courtesy of the proprietors of these establishments, the work has been greatly facilitated, and many carcasses which heretofore would have been marketed have been held for inspection before being offered for sale, on the grounds that the owners considered them to be of a suspicious nature. Owing to this system many carcasses have been condemned as unfit for food during the past two years.

Food Stuff. On January 23, 1910, the S. S. "Hyades" arrived in Kahului with a consignment of barley for the various plantations and stores on Maui. This barley had become wet on the trip and was fermented and moldy. As an outbreak of cerebro spinal meningitis had occurred the previous week, due to the animals eating moldy barley, and several valuable horses had died, I was requested by the consignees to examine this shipment. As a result of this examination the barley was condemned and returned to the Coast.

Report of Deputy Territorial Veterinarian for Kauai, 1909-1910.

By

A. REGINALD GLAISYER, D. V. M.

I have the honor to submit for your consideration a brief summary of conditions, from a veterinary standpoint, in the County of Kauai, since my arrival here March 31, 1909.

There have been but two outbreaks of a serious nature, viz.: one of the spinal meningitis during May, 1910, in the Hanamaulu stables of Lihue Plantation, and one of *Sclerostomum Equinum* at Kilaeua Plantation in July, 1910, with which you are personally conversant. The first named was stopped with a loss of four head and the second with a similar loss of four head. Since then there has not been a recurrence of either disease on these plantations.

It is encouraging to report that in these two years, we have not encountered a single case of glanders, and am unable to hear

of any for many years past, so that we may consider this Island to be free from that particular scourge.

In this connection it is earnestly to be recommended that some action be taken to insure this condition by the adoption of an inter-island inspection, which shall be to prevent this disease entering by means of horses or mules, purchased by private parties in Honolulu, Hilo or elsewhere. There are not many brought in now, but such as are should be inspected to insure us our present immunity. This would in no way interfere with the shipment of horses and mules from the Coast to this point, and would work no hardship to the importers of large numbers of stock, as they have previously had their B. A. I. examination by the Federal authorities.

Also in this connection mention should be made of the utmost necessity of a quarantine station on this Island to the end that animals may be shipped direct to this point without the additional cost of quarantine, feed, care, etc., in Honolulu, which usually adds 10 to 15 per cent. to the cost price of the animal.

The outlook, as far as tuberculosis is concerned, is not quite so encouraging. A number of herds have been tested with tuberculin with varying results, in only one of which have we failed to get a reaction. The percentage has been from three (3) to twenty-five (25) per cent. It is very gratifying to state that in all herds and dairies tested all animals reacting have been at once destroyed with the cordial consent of the owners, and also to note that in nearly every instance post mortem examination has shown the disease to the satisfaction of all parties concerned. The new intra-dermal reaction has not as yet been tried on this Island, but will be in the near future.

Although to a large extent destroyed by frogs, the liver fluke continues to infest the cattle, and can be found in nearly every animal butchered, but does not cause as great a loss in the herds as formerly.

The routine practice, as far as the plantations are concerned, consists chiefly of lameness, minor operations, pneumonia, colics, etc. It has been very striking in this regard to note the large percentage of colics due to volvulus and invagination of the intestine, of course terminating fatally. A record has not been kept, but, roughly speaking, it is thought that 15 per cent. would not be a bad estimate. By far the larger number of colics are impaction, chiefly of the large colon, undoubtedly due, in our estimation, to the ingestion of chopped cane tops, upon which the mules of this section are universally fed.

There have been a number of improvements and buildings for stabling stock in the last two years, amongst which may be noted an addition to stables at Kekaha, modern building for stabling

two hundred and fifty (250) head, with good water supply, veterinary operating room and table, etc., at Makaweli; new stable entire at Hanamaulu, and new one being erected in mauka lands of same plantation, veterinary hospital, table, accessories at Kealia, and the same in contemplation at McBryde and Kilauea.

It is also noticeable that the quality of stock being raised in the Island is being rapidly improved by good selection, both cattle and horses.

Mules have been and are being raised at Koloa large enough to do all forms of plantation work, though sired by an inferior jack. It is to be regretted that an imported jack, on this plantation, died before serving many mares, but such progeny as he got are of great promise, and to the writer have fully demonstrated the feasibility of raising large mules on this Island. Kekaha also raises a number of mules from a native jack, which are invaluable as pack animals, and make very serviceable mounts for field lunas. Kilauea has also recently imported a heavy stallion and jack and will raise their own work animals in the future.

In conclusion, the office of the Deputy Territorial Veterinarian wishes to express its appreciation of the support of the plantation managements, the County Supervisors, and the populace at large.

Board of Agriculture and Forestry.

PUBLICATIONS FOR DISTRIBUTION.

Any one or all of the publications listed below (except those marked *) will be sent to residents of this Territory, free, upon application to Mailing Clerk, P. O. Box 207, Honolulu.

BOARD.

Report of the Commissioner of Agriculture and Forestry for 1900; 66 pp.

Report of the Commissioner of Agriculture and Forestry for 1902; 88 pp.

* First Report of the Board of Commissioners of Agriculture and Forestry, from July 1, 1903, to December 31, 1904; 170 pp.

Second Report of the Board of Commissioners of Agriculture and Forestry, for the year ending December 31, 1905; 240 pp.; 8 plates; 10 text figures.

Third Report of the Board of Commissioners of Agriculture and Forestry, for the year ending December 31, 1906; 212 pp.; 3 plates; 4 maps; 7 text figures.

Fourth Report of the Board of Commissioners of Agriculture and Forestry, for the calendar year ending December 31, 1907; 202 pp.; 7 plates.

Fifth Report of the Board of Commissioners of Agriculture and Forestry, for the calendar year ending December 31, 1908; 218 pp.; 34 plates.

Report of the Board of Commissioners of Agriculture and Forestry, for the biennial period ending December 31, 1910; 240 pp.; 45 plates.

"Notice to Importers," by H. E. Cooper; 4 pp.; 1903.

"Digest of the Statutes Relating to Importation, Soils, Plants, Fruits, Vegetables, etc., into the Territory of Hawaii." General Circular No. 1; 6 pp.

"Important Notice to Ship Owners, Fruit Importers and Others: Rules and Regulations Prohibiting the Introduction of Certain Pests and Animals into the Territory of Hawaii." General Circular No. 2; 3 pp.; 1904.

"Law and Regulations, Importation and Inspection of Honey Bees and Honey." General Circular No. 3; 7 pp.; 1908.

....
"The Hawaiian Forester and Agriculturist," a monthly magazine. Vols. I to VII; 1904-1910. To be obtained from the Hawaiian Gazette Co., Honolulu. Price \$1 a year.

DIVISION ON ENTOMOLOGY.

"The Leaf-Hopper of the Sugar Cane," by R. C. L. Perkins. Bulletin No. 1; 38 pp.; 1903.

** "A Catalogue of the Hemipterous Family Aleyrodidae," by G. W. Kirkaldy, and "Aleyrodidae of Hawaii and Fiji with Descriptions of New Species," by Jacob Kotinsky. Bulletin No. 2; 102 pp.; 1 plate; 1907.

* "On Some Diseases of Cane Specially Considered in Relation to the Leaf-Hopper Pest and to the Stripping of Cane," by R. C. L. Perkins. Press Bulletin No. 1; 4 pp.; 1904.

"A Circular of Information," by Jacob Kotinsky. Circular No. 1; 8 pp.; 1905.

"The Japanese Beetle Fungus," by Jacob Kotinsky and Bro. M. Newell. Circular No. 2; 4 pp., cut; 1905.

Rule VII: "Concerning the Prevention of Distribution of the Mediterranean Fruit Fly"; unnumbered leaflet; 1910.

Rule VIII: "Concerning the Importation of all Banana Fruit, Banana Shoots or Plants"; unnumbered leaflet; 1911.

Report of the Division of Entomology, for the year ending December 31, 1905. Reprint from Second Report of the Board; 68 pp.; 3 plates; 10 text figures.

Report of the Division of Entomology, for the year ending December 31, 1906. Reprint from Third Report of the Board; 25 pp.; 7 text figures.

Report of the Division of Entomology, for the year ending December 31, 1907. Reprint from Fourth Report of the Board; 18 pp.; 1 plate.

Report of the Division of Entomology, for the year ending December 31, 1908. Reprint from Fifth Report of the Board; 26 pp.; 2 plates.

Report of the Division of Entomology, for the biennial period ending December 31, 1910. Reprint from Report of the Board; 70 pp.; 10 plates.

** This Bulletin will be sent only to persons interested in the subject

* Out of print.

Board of Agriculture and Forestry.

PUBLICATIONS FOR DISTRIBUTION—Continued.

DIVISION OF ANIMAL INDUSTRY.

- * "Inspection of Imported Live Stock." Rule 1; 1 p.; 1905.
- * "Inspection and Testing of Imported Live Stock for Glanders and Tuberculosis." Rule 2; 1 p.; 1905.
- * "Concerning Glandered Horse Stock in the Territory." Rule 3; 1 p.; 1905.
- * "To Amend Rule 1, Inspection of Imported Live Stock." Rule 4; 1 p.; 1907.
- * "Quarantine of Horse Stock from California." Rule 8; 1 p.; 1908.
- "Rules and Regulations, Inspection and Testing of Live Stock." Rules and Laws; 11 pp.; unnumbered pamphlet; Revised 1910.
- Report of the Division of Animal Industry, for the year ending December 31, 1905. Reprint from Second Report of the Board; 62 pp.
- Report of the Division of Animal Industry, for the year ending December 31, 1906. Reprint from Third Report of the Board; 41 pp.; 3 plates.
- Report of the Division of Animal Industry, for the year ending December 31, 1907. Reprint from the Fourth Report of the Board; 104 pp.; 6 plates.
- Report of the Division of Animal Industry, for the year ending December 31, 1908. Reprint from Fifth Report of the Board; 44 pp.
- Report of the Division of Animal Industry, for the biennial period ending December 31, 1910. Reprint from Report of the Board; 59 pp.; 13 plates.

DIVISION OF FORESTRY.

- * "Forest and Ornamental Tree Seed for Sale at Government Nursery." Press Bulletin No. 1; 3 pp.; 1905.
- * "Suggestions in Regard to the Arbor Day Tree Planting Contest." Press Bulletin No. 2; 7 pp.; 1905.
- "An Offer of Practical Assistance to Tree Planters." Circular No. 1; 6 pp.; 1905.
- "Revised List of Forest and Ornamental Tree Seed for Sale at the Government Nursery." Press Bulletin No. 3; 4 pp.; 1906.
- * "Instructions for Propagating and Planting Forest Trees." Press Bulletin No. 4; 4 pp.; 1906.
- "Instructions for Planting Forest, Shade and Ornamental Trees." Press Bulletin No. 5; 7 pp.; 1909.
- "Na Hoakaka no ke Kanu Ana i na Laau Malumalu ame na Laau Hoohiwahiwa." Press Bulletin No. 6; 8 pp.; 1909.
- Report of the Division of Forestry, for the year ending December 31, 1905. Reprint from Second Report of the Board; 77 pp.; 5 plates.
- * Report of the Division of Forestry, for the year ending December 31, 1906. Reprint from Third Report of the Board; 123 pp.; 4 maps.
- Report of the Division of Forestry, for the year ending December 31, 1907. Reprint from Fourth Report of the Board; 70 pp.
- Report of the Division of Forestry, for the year ending December 31, 1908. Reprint from Fifth Report of the Board; 85 pp.
- Report of the Division of Forestry, for the biennial period ending December 31, 1910. Reprint from Report of the Board; 86 pp.; 22 plates.

* Out of print.

